Volume Title: Preventing Currency Crises in Emerging Markets

Volume Author/Editor: Sebastian Edwards and Jeffrey A. Frankel, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-18494-3

Volume URL: http://www.nber.org/books/edwa02-2

Conference Date: January 2001

Publication Date: January 2002

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URL: http://www.nber.org/chapters/c10634

2

Are Trade Linkages Important Determinants of Country Vulnerability to Crises?

Kristin J. Forbes

2.1 Introduction

The latter half of the 1990s was punctuated by a series of financial and currency crises: the Mexican peso collapse in 1994; the East Asian crisis in 1997–98; the Russian collapse in 1998; and the devaluations in Brazil and Ecuador in 1999. One striking characteristic of many of these crises was how an initial country-specific event was rapidly transmitted to markets of very different sizes and structures around the globe. These events have prompted a surge of interest in "contagion" and in the determinants of a country's vulnerability to crises that originate elsewhere in the world. Despite this interest, however, there continues to be little agreement on why many of these crises that began in relatively small economies had such large global repercussions.

One channel through which a country-specific crisis could have global repercussions is trade. If two countries trade directly, export to the same country, or simply compete in the same industry, then a crisis in one of the countries could change the relative prices or quantities of goods traded by that country and have spillover effects in the other economy. Theoretical models have shown exactly how these trade linkages could transmit a crisis in one country to another country. There is an ongoing debate, however, on

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The author wishes to thank Sebastian Edwards, Jeffrey A. Frankel, Federico Sturzenegger, and conference participants for useful suggestions and comments.

whether these trade linkages have been large or significant determinants of how different countries were affected by recent financial crises.

Informal evidence suggests why this debate is unresolved. There is little direct trade between Brazil and Russia, and even minimal competition in third markets between these two countries. Brazil, however, was severely impacted by the Russian crisis in 1998, suggesting that trade linkages may not have been important in the transmission of this crisis. On the other hand, Argentina is one of Brazil's major trading partners. Argentina is also one of the countries most affected by Brazil's devaluation in 1999, suggesting that trade may have been important in the transmission of the Brazilian crisis. Numerous other examples from the series of currency crises in the 1990s could support either of these arguments.

This paper addresses the debate on whether trade linkages were important determinants of countries' vulnerability to recent currency crises. It decomposes trade linkages into three channels by which a country could be affected by a crisis elsewhere in the world: a competitiveness effect (in which changes in relative prices affect a country's ability to compete abroad); an income effect (in which a crisis affects incomes and the demand for imports); and a cheap-import effect (in which a crisis reduces import prices for a trading partner and acts as a positive supply shock). Then the paper uses data on aggregate trade flows and four-digit industry trade flows to measure the strength of these three channels between every country experiencing a crisis from 1994 through 1999 and a sample of developed and developing countries around the world.

Using these statistics, the paper estimates how trade linkages affected a country's stock market returns during recent crises. It finds that the competitiveness and income effects are both negative, significant, and economically important. In other words, if a country competes in the same industries as a crisis country, or exports directly to the crisis country, then the country will have significantly lower stock returns during the crisis. There is also weak evidence of a positive cheap-import effect. The combined impact of these three trade linkages appears to be much greater than that of other macroeconomic variables. These trade linkages, however, explain only about one-fourth of the variation in stock market returns during recent crises, suggesting that other cross-country linkages, such as financial channels, may also be important.

A final result from this empirical analysis is that the way a country responds to a currency crisis is an important determinant of how the crisis impacts other economies. For example, countries respond to pressure on their exchange rates by devaluing their own currencies (or allowing them to depreciate). Other countries attempt to maintain stable currency values and instead increase interest rates significantly. Other countries pay out international reserves, or use some combination of these three defenses. Empirical results suggest that the competitiveness effect is large and significant

only when a crisis country allows its currency to be devalued (or to depreciate) substantially. Results also suggest that the income effect is large and significant only when a crisis country raises interest rates substantially. Therefore, the importance of trade linkages depends on how a country responds to the initial crisis. This has important implications for preventing and predicting how future crises spread internationally.

This paper makes a number of contributions to the literature. First, it emphasizes that the term *trade* actually captures several different (and possibly counteracting) channels that can be divided into three distinct effects: competitiveness, income, and cheap-import effects. Second, it creates a number of new and more accurate statistics to measure these trade linkages. For example, most papers attempting to measure trade competition in third markets analyze aggregate trade flows to common markets. The fact that two countries are highly dependent on a common market, however, does not mean the two countries compete directly. For example, if a high proportion of Saudi Arabia's oil and of Brazil's coffee goes to the same third market, Saudi Arabia and Brazil are not direct competitors. By focusing on trade in specific industries, instead of aggregate trade flows, this paper's statistics provide more accurate measures of trade competition.

Fourth, and finally, by utilizing this industry-level trade data, the paper can reduce any omitted-variables bias. More specifically, several papers finding that trade linkages help transmit crises admit that trade flows are highly correlated with financial flows. It is extremely difficult to disentangle these linkages (and even to measure financial linkages), so estimates of the importance of trade linkages may actually be capturing the impact of financial linkages.[1] Financial flows are generally country specific and similar across industries, however, whereas many trade flows vary across industries. Therefore, by using industry-level data, this paper can more accurately identify the impact of trade linkages and reduce any omitted-variables bias.

The remainder of this paper is as follows. Section 2.2 reviews previous empirical work assessing the importance of trade in the international transmission of crises. Section 2.3 surveys the related theoretical work, and then uses this work to decompose trade into three different (and possibly opposing) linkages. Section 2.4 uses an index of exchange rates, interest rates, and reserve levels to identify the crisis events used in the rest of the paper. Section 2.5 introduces the model and data set and calculates a number of statistics measuring trade linkages across countries. It discusses these statistics, especially the industry-based competitiveness measure, in some detail. Section 2.6 presents regression estimates, including an extensive series of sensitivity tests. It finds that competitiveness and income effects are

1. Glick and Rose (1999), Kaminsky and Reinhart (2000), and Van Rijckeghem and Weder (2001) all raise this point.

significant and economically important determinants of country vulnerability to crises. Section 2.7 examines different types of crises and shows that the way a country responds to exchange-market pressure determines which trade linkages are important transmission mechanisms. Finally, section 2.8 summarizes the key results of the paper and concludes with an important policy implication.

2.2 The Empirical Literature: Is Trade Important?

A number of empirical papers have attempted to measure the importance of trade in the international transmission of crises. This section discusses the basic methodology and results of each of these papers. It begins with three empirical papers arguing that trade linkages are important determinants of how crises spread. Then it discusses three papers that claim that trade linkages were not important during recent crises. The section concludes by summarizing three recent papers arguing that trade linkages are important, but overshadowed by other transmission mechanisms.

One of the first empirical papers to assess the importance of trade and find strong support for this propagation mechanism was Eichengreen and Rose (1999). This paper uses a binary-probit model to test whether the probability of a crisis occurring in twenty industrial countries between 1959 and 1993 is correlated with the occurrence of a speculative attack in other countries at the same time. In one series of tests, the authors weight the occurrence of crises in other countries by a trade matrix (which is based on bilateral trade flows in manufacturing[2]) and by a matrix of macroeconomic variables. They find that this trade-weighted matrix is highly significant and robust, while the macro-weighted matrix is insignificant. They conclude that their results lend "some support to our favored interpretation that it is trade links rather than macroeconomic similarities that have been the dominant channel for the contagious transmission in the sample period" (1999, 50).[3]

Glick and Rose (1999) build on this framework in the most complete and thorough analysis, to date, of the role of trade in the international transmission of crises. They focus on five major currency crises between 1971 and 1997 and test whether the probability of a country being attacked during a crisis is affected by trade linkages between that country and the crisis country. Glick and Rose include a much larger sample of countries than do Eichengreen and Rose (1999) and use a number of different statistics to measure trade linkages. They focus on a trade statistic measuring exports to

2. More specifically, this weighting matrix is based on the MERM weights constructed by the International Monetary Fund and used to compute its real effective multilateral exchange rates. The weights, created in October 1994, are based on unit labor costs, use a convex combination of import and export trade flows, and are time-invariant.

3. The working paper version was Eichengreen, Rose, and Wyplosz (1996).

common third markets, although they also run sensitivity tests using bilateral trade flows, a combination of these two statistics, and exports to common markets weighted by country size. These trade measures are consistently large and significant, indicating that "a stronger trade linkage is associated with a higher incidence of currency crises" (1999, 613). Once again, macroeconomic controls are generally insignificant.

Instead of using aggregate trade flow data, Forbes (2000) uses firm-level information to measure the importance of trade in the international transmission of crises. The paper's sample includes information on more than 10,000 companies from around the world during the Asian and Russian crises. It focuses on the variation in different companies' stock market performance to test not only which types of companies were most affected by these crises, but also how these crises spread internationally. Results show that companies that had sales exposure to the crisis country or that competed in the same industry as the crisis country had significantly lower stock returns during these two crises. The paper concludes that direct trade effects (called *income effects*) as well as competition in export industries (called *product-competitiveness effects*) "were both important transmission mechanisms during the later part of the Asian crisis and the Russian crisis" (Forbes 2000, 1 [abstract]).

Although these three papers find strong evidence for the role of trade, a number of other empirical papers argue that trade was not important in the propagation of recent crises. In one of the earliest papers classifying specific channels through which crises spread internationally, Masson (1998) categorizes trade as a spillover and argues that spillovers were not important during the 1994 Mexican crisis or the 1997 Asian crisis. He argues that since exports to Mexico and Thailand constituted a small proportion of total exports from their neighbors, regional spillover effects through trade would have been modest. Masson also calculates the loss in competitiveness of five Asian countries (as measured by changes in their real effective exchange rates) during the Asian crisis. Since this competitiveness effect was small (at least before the November depreciation of the won), he argues that these spillovers cannot explain the spread of the crisis from Thailand throughout Asia. Masson concludes that spillover effects "cannot explain the coincidence of speculative pressures felt by a number of emerging market economies at the time of the Mexican and Thai crises" (Masson 1998, 3).

Baig and Goldfajn (1998) also argue that trade was not important in the spread of the Asian crisis. They calculate direct trade flows between each of the East Asian economies, and assert that "they are not adequate to account for what happened in East Asia. The trade linkages among the five countries in discussion are not very striking. . . . The export share to Thailand constituted less than 4 percent of total exports for each of the four countries in discussion, making intra-country trade an unlikely source of pressure on financial markets." Baig and Goldfajn also consider indirect trade linkages,

such as export competition in the United States and Japan, but "don't find much evidence in support of this argument either. The Asia 5 countries do not share very similar third-country export profiles that would amount to severe competitiveness pressures" (Baig and Goldfajn 1998, 7).

Another paper that argues that trade was not significant has a more limited focus. Harrigan examines how the Asian crisis affected prices and volumes in different U.S. manufacturing sectors. He concludes that "[t]he impact of the Asia[n] crisis on U.S. industries was small and localized. Only one sector, the steel industry, experienced falling prices and output in the wake of the crisis" (2000, 79). Harrigan admits that there was a decreased demand for U.S. manufactured goods in Asia during the crisis, but claims that this was offset by increased demand elsewhere in the world (including within the United States). He also reports that U.S. import volumes from Asia increased only moderately during this period, despite the large fall in import prices, because U.S. demand for Asian imports is relatively inelastic.

These three papers argue that trade was not important in the international transmission of recent crises, and the first three papers discussed in this section argue that trade was important. Most recent empirical work, however, takes an intermediate stance and claims that trade linkages can have some role, but that they are generally overshadowed by other factors.[4] In one such paper, Kaminsky and Reinhart (2000) examine the spread of the Mexican and Asian crises. They use both bilateral and third-country trade linkages (measured by export shares in similar industries) to construct "trade cluster" statistics. They then use these statistics to estimate how trade affects the conditional probability that an initial crisis will spread to other countries. They find that the bilateral-trade cluster for Latin America is more important than for other regions, but emphasize that all of these trade measures are less influential than financial linkages. They conclude that trade may have played some role in the transmission of the Thai crisis to Malaysia, Korea, and the Philippines, but that it "can certainly not help explain Argentina and Brazil following the Mexican devaluation nor Indonesia following the Thai crisis" (2000, 167).

Van Rijckeghem and Weder (2001) also argue that financial linkages may be more important than trade linkages in explaining country vulnerability to crises. They use data from the Bank for International Settlements (BIS) to construct several measures of competition for bank funds during the Mexican, Thai, and Russian crises. Then they use these statistics, as well as a series of trade and macroeconomic variables, to estimate the conditional probability that an initial crisis will affect other countries. They find that if

4. More recently, a number of papers have tested for the relative importance of trade flows, financial linkages, and macroeconomic variables in the transmission of recent crises. These papers build on one or more of the approaches outlined in this section. They generally find that trade linkages are important but overshadowed by other transmission channels. For example, see Caramazza, Ricci, and Salgado (2000), De Gregorio and Valdés (2001), or Gelos and Sahay (2001).

either trade linkages *or* financial linkage are included in the model, the variables are usually highly significant. When both trade and financial linkages are included simultaneously, however, one of the two often becomes insignificant. They conclude that "spillovers through common bank lenders were important in transmitting" these three crises, and emphasize that "trade and financial linkages appear to be highly correlated," thereby making it difficult to differentiate empirically between these two effects (Van Rijckeghem and Weder 2001, 12–13).

Wincoop and Yi (2000) also find mixed support for trade linkages in their examination of the impact of the Asian crisis on short-run U.S. gross domestic product (GDP) growth. They argue that the Asian crisis spread to the United States through three channels: decreased demand for U.S. exports due to the recession in Asia; exchange-rate movements that reduced the U.S. price of imports from Asia; and capital outflows from Asia that lowered the cost of capital and therefore increased demand in the United States. They estimate that the significant negative impact on U.S. growth from the first effect was entirely counteracted by the positive impact on U.S. growth from the third effect. (The estimated impact of second effect was minor.) Therefore, Wincoop and Yi suggest that even though the Asian crisis directly affected the United States through trade, this effect was entirely offset by other transmission channels.

To summarize, a number of empirical papers have tested for the role of trade in the international transmission of currency crises. The results are as varied as the approaches and techniques used. Some papers argue that trade linkages were large and significant; others argue that they were not important, especially in the spread of the Mexican, Asian, and Russian crises. Some of the most recent papers find a small role for trade—although one generally overshadowed by other propagation channels. Therefore, this debate on the importance of trade in the international transmission of recent crises can be resolved only through further careful empirical work.

2.3 The Theory: Why Might Trade Be Important?

The theoretical literature modeling exactly how trade can transmit crises is much more limited than the empirical literature testing for its importance. This section begins by briefly summarizing the key theoretical papers on the subject. Then it develops a framework for the empirical analysis in the remainder of the paper. It emphasizes that trade incorporates three distinct channels: a competitiveness effect, an income effect, and a cheap-import effect. Since any two of these channels could work in opposite directions, it is necessary to control simultaneously for each of them when analyzing the importance of trade in a country's vulnerability to financial crises.

Gerlach and Smets (1995) is the first paper to model formally how a devaluation in one country can affect trade flows and thereby cause a crisis in another country. In their model, two countries are linked through trade in

merchandise and financial assets. A successful attack on one country's exchange rate causes a devaluation and improves the competitiveness of that country's merchandise exports. This produces a trade deficit in the second country and a gradual decline in its central bank's international reserves. This ultimately leads to a speculative attack on the second country's currency. Gerlach and Smets also model a secondary effect of the initial devaluation. This devaluation lowers import prices in the second country, which reduces the aggregate price level and domestic demand. Residents of the country swap domestic currency for foreign exchange, which further depletes the central bank's holdings of international reserves. As a result, the second country could shift to an equilibrium in which the central bank does not hold enough reserves to withstand a speculative attack.

Corsetti et al. (2000) use microfoundations to develop a more detailed and rigorous model of how trade can transmit crises internationally. They model two channels through which a devaluation in one country can affect other countries. In the first channel, the devaluation lowers the relative price of a country's exports and therefore shifts demand away from countries that produce similar goods. In the second channel, the cheaper exports improve the terms of trade for other countries, allowing them to finance higher levels of consumption for any given levels of nominal income. Either of these two effects could dominate, so that a devaluation in one country does not necessarily lead to a welfare loss in other countries. In fact, under certain situations the second channel could dominate, and the country that devalues could "beggar thyself" while simultaneously generating a welfare improvement for other countries.

These theoretical papers explain how trade can transmit crises internationally.[5] A key point from this literature, especially when combined with the empirical review in section 2.2, is that trade incorporates a number of distinct channels. As clearly shown in Corsetti et al. (2000) and Wincoop and Yi (2000), the various channels that constitute trade could counteract each other. As a result, the aggregate impact of trade linkages could be small, even though individual trade channels are large and significant. Therefore, any empirical work on how trade linkages transmit crises should control for each of these channels simultaneously.

5. One additional theoretical paper that deserves note is Paasche (2000). This paper does not focus on trade per se but shows how a small shock to a country's terms of trade (which could be caused by a devaluation elsewhere in the world or by a reduction in demand for a country's exports) can be magnified by credit constraints and thereby have large domestic consequences. This type of model could be combined with any of the other theoretical models to amplify these trade effects. Also see Harrigan (2000) and Pesenti and Tille (2000). Harrigan provides a nontechnical discussion of the effect of the Asian devaluations on prices and quantities in the United States and Asia. Pesenti and Tille discuss the direct impact of bilateral trade flows between countries, as well as the indirect impact of competition in third markets. They provide several numerical examples to show how a devaluation in one country could affect other countries through competition in third markets.

The empirical analysis in the remainder of this paper follows this approach. It attempts to measure simultaneously whether these three trade linkages were important determinants of how recent crises impacted other countries. More specifically, it focuses on three trade channels: a competitiveness effect, an income effect, and a cheap-import effect. The competitiveness effect is the first channel modeled in Corsetti et al. (2000). This trade effect occurs when one country devalues its currency, reducing the relative price of that country's exports and shifting demand away from goods that compete with those exports. If exports from the crisis country constitute a large enough share of global production in a given industry, prices in that industry could fall worldwide. Therefore, even if a country does not directly compete with exports from the crisis country in any specific markets, its export competitiveness could be damaged through these global industry effects.[6]

The second trade channel is what this paper calls an income effect.[7] This occurs when a crisis affects a country's income level (or even its income distribution) and growth rate, which in turn affects that country's demand for imports. Other countries that export directly to the crisis country will experience shifts in demand for their goods. Most of the empirical work discussed in section 2.2 assumes that any income effect is negative, since recent crises have generated a sharp contraction in economic growth and reduction in aggregate demand (within the crisis country). The historical evidence on the impact of currency crises on growth and demand, however, is mixed.[8] In many cases a currency crisis leads to a devaluation, which improves growth performance and aggregate demand in the crisis country. Therefore, the sign of any income effect is a priori indeterminate.

The final trade channel that this paper examines is a cheap-import effect.[9] This occurs when a country devalues its currency, reducing the relative price of its exports and improving the terms of trade in other countries. Imports into noncrisis countries are now available at cheaper prices, potentially allowing them to finance higher levels of consumption for any given levels of nominal income. This trade linkage could have a positive impact on a country's welfare when a crisis occurs elsewhere in the world.

To summarize, this paper tests whether three trade channels (competitiveness, income, and cheap-import effects) are important determinants of

6. There could also be secondary competitiveness effects if exports from the country that devalued are used as inputs for the production of goods in other countries. In this case, the currency crisis could improve, rather than reduce, the competitiveness of these products.

7. Wincoop and Yi (2000) call this a domestic demand effect.

8. For example, Gupta, Mishra, and Sahay (2000) examine the response of output during crises. They find that about 40 percent of crises have been expansionary. Also see Goldstein, Kaminsky, and Reinhart (2000, chap. 7), for a survey of the literature examining how currency crises affect a variety of economic indicators.

9. This is also called the bilateral trade effect in Corsetti et al. (2000) and the supply effect in Wincoop and Yi (2000).

a country's vulnerability to recent financial crises. This paper does not test for the importance of other transmission channels, such as common bank lenders, capital flows' responding to changes in interest rates, or changes in investor sentiment. Although these other channels are undoubtedly important and may even interact with trade flows, this paper maintains its narrow focus in order to assess the significance and magnitude of these trade linkages carefully.

2.4 The Crisis Events

In order to test for the role of trade linkages during recent crises, it is necessary to begin by defining exactly when these crises occurred. In many cases, such as the Mexican peso devaluation in December 1994, it is not only clear that a crisis occurred, but also fairly straightforward to date when the crisis began. Other cases, however, are much more difficult to define. For example, in the aftermath of the Mexican devaluation, Argentina raised short-term interest rates to 44 percent (versus about 7 percent immediately before the Mexican crisis) and still suffered a large outflow of reserves.[10] Does this qualify as a crisis? Or, even though Brazil did not devalue its currency until January 1999 (an event that most people would agree is a crisis), how should we classify periods such as the week in early September 1998, when Brazil raised interest rates from about 20 to 40 percent to forestall a devaluation?

These situations suggest that focusing only on exchange rate movements may miss important periods of pressure on a country's currency. Therefore, I follow a convention frequently used in the currency crisis literature and construct an "exchange-market pressure index," which accounts for movements in a country's exchange rate, interest rate, and reserve levels. Although this index is somewhat ad hoc, it does capture the three main defenses (devaluing its currency, raising interest rates, or paying out reserves) that a country has against a speculative attack. More specifically, I construct a weighted index of exchange-market pressure (EMP) similar to that introduced in Eichengreen, Rose, and Wyplosz (1996):

$$(1) \qquad EMP_{nt} = \alpha\%\Delta e_{nt} + \beta[(i_{nt} - i_{Ut}) - (i_{ny} - i_{Uy})] - \gamma(\%\Delta r_{nt} - \%\Delta r_{Ut}),$$

where e_{nt} is the nominal exchange rate for country n's currency in U.S. dollars at time t; i_{nt} is the short-term interest rate for country n at time t; i_{Ut} is the short-term interest rate for the United States at time t; i_{ny} and i_{Uy} are the same two interest rates calculated as rolling averages for the previous year (starting at date $t-1$)[11]; and r_{nt} and r_{Ut} are the ratios of international reserves

10. Data sources are discussed below.

11. This component of the index is generally calculated as a period-to-period change instead of a period-to-year change. I depart from this convention to adjust for the fact that a country may raise interest rates to defend its currency for longer than one period. This is particularly important for this paper's analysis because the time periods (t) are weeks instead of months or quarters.

to the money supply for country *n* and the United States, respectively. Each component of the index is entered so that higher values of the index indicate greater levels of EMP. Each component of the index is also weighted by the inverse of the standard deviation for each series (the α, β, and γ) in order to equalize conditional volatilities and ensure that no single series dominates the index.

In order to focus on recent currency crises (and to correspond with the trade data used in section 2.5), I calculate this EMP index for five years—from 1 July 1994 through 31 June 1999. The data for U.S. dollar exchange rates and short-term interest rates are compiled on a weekly basis from Datastream. The data on reserves and the money supply (M1) are collected from the International Financial Statistics CD-ROM published by the International Monetary Fund (IMF; 2000). This information is available on a monthly basis only, so I interpolate to estimate weekly statistics. Also, I exclude countries with an annual rate of consumer price inflation greater than 100 percent.[12] Further information on data sources and definitions is available at the beginning of the appendix. The resulting sample used to calculate the EMP index consists of the forty-five countries listed in the note to table 2.1.[13]

The final step is to specify the critical value for the EMP index such that index values above this level qualify as a crisis. I use the criteria

$$(2) \qquad \begin{aligned} Crisis_{nt} &= 1 \quad \text{if } \mathrm{EMP}_{nt} > \mu_{\mathrm{EMP}} + 5\sigma_{\mathrm{EMP}} \\ &= 0 \quad \text{otherwise} \end{aligned}$$

where $Crisis_{nt}$ is an indicator variable equal to 1 if a crisis occurs in country *n* at time *t*; μ_{EMP} is the mean of the EMP index; and σ_{EMP} is the standard deviation of the index. These criteria generate forty-one country-week crisis periods.[14] Many of these one-week crisis periods, however, are clearly part of a single crisis event (e.g., Mexico has 5 one-week "crises" between 19 December 1994 and 19 March 1995). Therefore, I include any crisis-week that occurs within one year of a country's initial crisis as part of a single crisis

12. Adjusting this cutoff to either 50 or 150 percent has minimal impact on the results. I also exclude Kenya, Luxembourg, Pakistan, Russia (before 1997), and Sri Lanka because none of these countries has the trade data during this period that are necessary for the analysis in the remainder of the paper.

13. Since this paper uses weekly data and includes interest rates as one component of the EMP index, the sample of countries is smaller than in other papers that calculate a similar crisis index. The shorter time periods are critical, however, to identifying the crisis windows accurately, as well as to capture short periods of intense EMP. Moreover, the focus of this paper is to measure country vulnerability to these crises, and the sample of countries used for this analysis is larger.

14. The sensitivity analysis examines the impact of using lower critical values to define the crisis events. As shown in section 2.6, this has no significant impact on results. I focus on the stricter definition of a crisis for two reasons. First, a less stringent definition includes many events that are not intuitively crises. Second, and most important, a less stringent definition identifies a number of weeks as crises that occur simultaneously in different countries. This complicates any empirical analysis of how each crisis affects other countries.

Table 2.1 **The Crisis Events**

Country	Crisis Event Dates
Mexico	12/19/94–12/25/94; 01/16/95–01/29/95; 02/27/95–03/05/95; 03/13/95–03/19/95
Ecuador (1)	01/23/95–02/12/95; 10/30/95–11/05/95
Argentina	03/06/95–03/12/95
Venezuela (1)	12/11/95–12/17/95; 04/15/96–04/21/96
Venezuela (2)	05/12/97–05/18/97
Czech Republic	05/19/97–05/25/97
Thailand	06/30/97–07/06/97
The Philippines	07/07/97–07/13/97; 09/29/97–10/05/97
Indonesia	08/11/97–08/17/97; 08/25/97–08/31/97; 09/29/97–10/05/97; 12/08/97–12/14/97; 01/19/98–01/25/98; 03/02/98–03/08/98; 05/18/98–05/24/98
Korea	12/29/97–01/04/98
India	01/19/98–01/25/98
Russia	05/18/98–05/31/98; 07/06/98–07/12/98; 08/10/98–09/06/98; 09/14/98–09/20/98
Venezuela (3)	06/15/98–06/21/98; 09/14/98–09/20/98
Slovak Republic	09/28/98–10/04/98
Ecuador (2)	10/19/98–10/25/98; 01/11/99–01/17/99; 03/01/99–03/07/99
Brazil	01/11/99–01/17/99

Notes: Crises are defined as weeks when $EMP_{nt} > \mu_{EMP} + 5\sigma_{EMP}$. Countries included in the sample to test whether they experienced a crisis between 1 July 1994 and 31 June 1999 are Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Czech Republic, Denmark, Ecuador, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Malaysia, Mexico, Morocco, the Netherlands, New Zealand, Norway, Peru, the Philippines, Poland, Portugal, Russia (after 1996), Singapore, Slovak Republic, South Africa, Spain, Sweden, Switzerland, Thailand, United Kingdom, and Venezuela. The United States is included in the sample but cannot experience a crisis due to the way the index is defined.

event. In other words, a country can have, at most, one crisis per year. This generates a sample of sixteen recent crises, listed chronologically in table 2.1. The weeks included in each crisis event are listed in the second column of the table. The average length of a crisis is 2.6 weeks.

This list captures most of the recent events that gained attention as major currency crises, as well as a number of less publicized events. For example, the list includes the most obvious crises since mid-1994: the Mexican devaluation in December 1994; the Thai crisis in July 1997; the Korean devaluation in December 1997; the Russian crisis in August 1998; and the Brazilian devaluation in January 1999. It also includes some less obvious

crises, such as the pressure on Argentina's peso in March 1995 and on India's rupee in January 1998. Many of these events do not include a major currency devaluation, but instead reflect a significant rise in interest rates or a loss in reserves to counter the pressure on the exchange rate.[15] One interesting pattern in table 2.1 is that crises tend to be bunched in time as well as by region. For example, there were several crises in Latin America at the end of 1994 and throughout 1995. This was followed by a relatively calm period, until the Thai devaluation in 1997 was quickly followed by a series of crises across Asia.

2.5 The Model, Data, and Trade Statistics

Now that the crisis events have been identified, it is possible to estimate whether the three trade channels are important determinants of a country's vulnerability to recent crises. For simplicity, I refer to the country experiencing the initial crisis as the ground-zero country.[16] The base model, which is estimated for the sample of sixteen crises, is

$$(3) \qquad Return_{n,e} = \theta_1 Compete_{n,e} + \theta_2 Income_{n,e} + \theta_3 Cheap\ Import_{n,e} + \theta_4 \boldsymbol{X}_{n,e} + \theta_5 \boldsymbol{P}_e + \varepsilon_{n,e},$$

where $Return_{n,e}$ is the stock market return for country n over the crisis event e; $Compete_{n,e}$ is a measure of any competitiveness-effect linkages between country n and the ground-zero country; $Income_{n,e}$ is a measure of any income-effect linkages between country n and the ground-zero country; $Cheap\ Import_{n,e}$ is a measure of any cheap-import effect linkages between country n and the ground-zero country; $\boldsymbol{X}_{n,e}$ is a set of macroeconomic control variables for country n; and $\boldsymbol{P}_e$ is a set of period dummies (for each crisis event e). These period dummies are included to control for any global events or aggregate shocks that affect all countries during the crisis. Each of the independent variables is measured during the year prior to the starting date of the crisis; for example, the trade and macroeconomic variables for the Thai crisis (which began in June 1997) are measured in 1996.[17] This timing convention is used so that the independent variables do not incorporate any impact of the crisis.

This model focuses on stock returns (the dependent variable) to measure a country's vulnerability to a crisis for several reasons. First, stock returns are available for a large sample of countries (an even larger sample than that used to calculate the crisis index). Second, since stock returns are measured

15. Section 2.7 analyzes how these different types of crises (i.e., largely driven by currency devaluations versus interest rate increases) determine how a crisis affects other countries.

16. This terminology is borrowed from Glick and Rose (1999).

17. The one exception is the Mexican crisis (which occurred during various weeks between 19 December 1994 and 19 March 1995. Due to data limitations for the trade variables, the independent variables are measured in 1994. Since the crisis occurred near year-end, however, there should be minimal feedback on the annualized trade and macroeconomic variables.

at a much higher frequency than most macroeconomic and trade variables, stock returns can more accurately pinpoint the effects of a specific crisis. This is particularly important when a series of crises (such as those in Thailand, the Philippines, and Indonesia) are bunched together in time. Third, since stock returns incorporate the immediate impact of a crisis as well as the expected longer-term effects, stock returns should capture the total impact of a crisis on a particular country. Granted, stock returns also have a number of shortcomings. Any sort of investor behavior that drives markets from their long-term equilibria could reduce the ability of stock returns to capture the long-term impact of a crisis accurately.[18] Despite these shortcomings, stock returns are the most accurate indicator available for a large sample of countries at the high frequency necessary to isolate the impact of different crises that occur close together in time.

The data used to measure each of the variables in equation (3) come from a variety of sources. For the base analysis, stock returns ($Return_{n,e}$) are measured as abnormal weekly stock returns (written as percentages) for the market index in country n expressed in U.S. dollars.[19] The stock index data are from Datastream. For crisis events that last longer than one week, $Return_{n,e}$ is calculated as the average abnormal stock return over each week that qualifies as a crisis (as specified in table 2.1). Therefore, for the Mexican crisis (which is defined as including the five weeks between 19 December 1994 and 19 March 1995), $Return_{n,e}$ is calculated as the average, abnormal, weekly stock return over the five weeks identified as crisis events in table 2.1. The macroeconomic variables are taken from the International Financial Statistics CD-ROM (IMF 2000) and the World Development Indicators CD-ROM (World Bank 2000). The appendix provides further information on each of these data sources and definitions, including a table of summary statistics.

The three trade linkage variables are calculated using data from the International Trade Center, UN Statistics Division (1999), which reports bilateral trade flows between most countries in the world by four-digit Standard Industrial Trade Classification (SITC) codes between 1994 and 1998. The competitiveness variable ($Compete_{n,e}$) is calculated as a weighted product of two terms. The first term is exports from the ground-zero country in a given industry as a share of global exports in that industry. This term captures how important exports from the crisis country are to the industry, and therefore the potential impact of the crisis on the industry as a whole. The

18. For example, Barberis, Shleifer, and Vishny (1998) show that markets tend to underreact to individual news and overreact to a long series of related news.

19. Abnormal stock returns are calculated as stock returns during the crisis period minus average returns (i.e., normal returns) for the year preceding the start of the crisis. One week preceding the start of the crisis is excluded from the calculation of normal returns in case there were any unusual market movements directly before the crisis.

second term is total exports from country *n* in the same industry, as a share of country *n*'s GDP. This term captures the importance of each industry to country *n*, and therefore country *n*'s potential vulnerability to the crisis. Finally, these products are calculated and summed across all four-digit industries for each country-crisis pair and weighted by the maximum calculated value (and multiplied by 100). This creates an index whose values can range from 0 to 100.[20] In other words, the competitiveness variable for country *n* during crisis event *e* can be written

$$Compete_{n,e} = \frac{100}{\text{Max}_{Compete}} \sum_{k} \left(\frac{\text{Exp}_{0,k,W}}{\text{Exp}_{W,k,W}} \cdot \frac{\text{Exp}_{n,k,W}}{\text{GDP}_{n}} \right) \tag{4}$$

where $\text{Exp}_{0,k,W}$ is exports from the ground-zero country in industry k to every other country in the world (W); $\text{Exp}_{W,k,W}$ is exports from every country in the world in industry k to every other country in the world; $\text{Exp}_{n,k,W}$ is exports from country n in industry k to every other country in the world; GDP_{n} is gross domestic product for country n; and $\text{Max}_{Compete}$ is the maximum value of the product in parentheses for every country-crisis pair in the sample. All variables are measured in U.S. dollars for the one-year period ending before the start of the crisis event e. The k industries are 1,075 four-digit SITC groups.

Since *Compete* is a key variable for this paper's analysis, tables 2.2 and 2.3 provide further information on this index. Table 2.2 presents a sample of values for the first ratio in the product in parentheses in equation (4). It lists the ten largest four-digit export industries for each ground-zero country (when measured as a share of world exports in each industry). Not surprisingly, smaller countries tend to have smaller shares of global exports in most industries. For example, the most important export industry for the Slovak Republic is flat, cold-rolled producers' iron (SITC group 6734), which comprises only 3.5 percent of global exports in this industry. Larger countries, on average, have larger shares of export industries. Korea, for example, accounts for 41 percent of the world's exports of fabric made of synthetic-filament yarn (SITC group 6531). Several small and medium-sized economies dominate specific export markets, however, especially for certain agricultural products and natural resources. For example, India accounts for 82 percent of world exports in castor oil seeds (SITC group 2235); the Philippines account for 58 percent of global exports in coconut oil fractions (SITC group 4223); the Czech Republic accounts for 51 percent of global exports in lignite (SITC group 3222); and Russia accounts for 48 percent of global exports in gaseous natural gas (SITC group 3432). Any other

20. Ideally, this competitiveness indicator would also incorporate the elasticities of substitution between goods from different countries. To the best of my knowledge, however, these statistics do not currently exist.

Table 2.2 Major Exports from the Crisis Countries

SITC Code	SITC Definition	Share of World Exports (%)
	Mexico: 1994	
7511	Typewriters, word-processing machines	24.9
2667	Synthetic staple fiber, spinning	20.0
2832	Copper mattes, etc.	19.6
2313	Other natural gums	19.6
0544	Tomatoes, fresh, chilled	16.4
7474	Safety, relief valves	15.7
7731	Insulated wire, etc. conductors	14.9
7611	Color television receivers	14.7
2483	Wood, coniferous, worked, shaped	14.3
6973	Domestic cooking, heating appliance, non-electric	11.3
	Ecuador: 1995	
2655	Abaca, manila hemp, waste	34.1
0573	Bananas, fresh or dried	22.5
6576	Hat-shapes, forms, bodies	12.8
0721	Cocoa beans	9.8
0361	Crustaceans, frozen	6.3
0593	Juice, other citrus fruit	5.0
0723	Cocoa paste	4.7
0711	Coffee, not roasted	4.3
0713	Extracts, etc. of coffee	2.6
0371	Fish, prepared, preserved, N.E.S.	2.4
	Argentina: 1995	
4215	Sunflower seed oil, etc.	35.5
4211	Soya bean oil, fractions	27.6
2224	Sunflower seeds	24.9
0176	Bovine meat, prepared, preserved, N.E.S.	23.3
4213	Groundnut oil, fractions	22.4
0124	Meat of horses, mules, etc.	18.6
0813	Oil-cake, oilseed residue	18.4
0616	Natural honey	17.1
0171	Extract, juice meat, fish	17.1
4212	Cottonseed oil, fraction	16.8
	Venezuela: 1995	
6724	Ingots of iron or steel	17.0
6713	Pellets, etc. of pig iron, etc.	12.8
2239	Flour, meal, from oilseeds	11.8
6932	Barbed wire, etc. of iron, steel	9.4
3330	Crude petroleum	8.1
5984	Mixed alkyl benzenes, etc., N.E.S.	5.3
6841	Aluminum, aluminum alloy, unwrought	4.8
4218	Sesame oil, fractions	4.7
0471	Other cereal flours	4.4
6733	Flat, cold-rolled, production iron	3.7

Table 2.2 (continued)

SITC Code	SITC Definition	Share of World Exports (%)
	Czech Republic: 1997	
3222	Lignite	50.6
6576	Hat-shapes, forms, bodies	13.1
2784	Asbestos	9.5
6999	Articles tungsten, etc., N.E.S.	8.4
2516	Chemical wood pulp, sulphite	8.3
2237	Oil seeds, etc., N.E.S.	7.7
6659	Glass articles, N.E.S.	7.6
5811	Artificial sausage casings	7.1
3250	Coke, semi-coke, ret. carbon	6.9
8913	Non-military arms	6.5
	Thailand: 1997	
2311	Natural rubber latex	47.2
0548	Vegetable products, roots, tubers	38.2
0423	Rice, milled, semi-milled	37.8
2312	Natural rubber, excl. latex	36.5
6129	Other leather articles, N.E.S.	27.5
0372	Crustacea, mollusk, prepared, N.E.S.	27.4
6673	Precious, semiprecious stones	23.6
0471	Other cereal flours	22.4
0621	Fruit, etc. preserved by sugar	20.7
2732	Gypsum, limestone, etc.	20.1
	The Philippines: 1997	
2655	Abaca, manila hemp, waste	58.4
4223	Coconut oil fractions	58.3
2231	Copra	15.9
2657	Coconut fiber and waste	14.9
2841	Nickel ores, concentrates	12.9
2891	Precious metal ore, concentrates	12.8
8451	Babies' garments, clothes, accessories	8.9
8437	Shirts, mens', boys', knit	8.3
8944	Festive articles, etc., N.E.S.	7.3
3442	Gas hydrocarbon, liquid, N.E.S.	6.7
	Indonesia: 1997	
6343	Plywood, solely of wood	44.8
3431	Natural gas, liquified	44.8
4224	Palm kernel oil, fractions	44.3
0721	Cocoa beans	35.4
2831	Copper ores, concentrates	32.0
2312	Natural rubber, excl. latex	31.6
4223	Coconut oil, fractions	27.2
8512	Sports footwear	26.9
6344	Other plywood, veneered panels	24.4
6871	Tin, tin alloys, unwrought	20.2

(*continued*)

Table 2.2 (continued)

SITC Code	SITC Definition	Share of World Exports (%)
	Korea: 1997	
6531	Fabric, synthetic-filament yarn	40.8
6118	Leather, special finish	32.1
6562	Labels, badges, etc., not embroidered	29.3
7917	Rail, tram, coach, etc., N.E.S.	27.1
8831	Cine film, 35mm+, developed	26.6
6132	Heads, tails, paws, etc.	25.6
7932	Ships, boats, other vessels	23.8
7863	Transport containers	23.0
6551	Pile fabric, knit, crochet	23.0
6965	Other articles of cutlery	22.7
	India: 1998	
2235	Castor oil seeds	81.9
4225	Castor oil, fractions	80.3
6121	Leather belting, etc.	56.6
6116	Goat or kid skin leather	36.5
6545	Fabric, woven jute, other textile	34.1
0741	Tea	31.0
2922	Natural gums, resins, etc.	29.9
2225	Sesame (sesamum) seeds	27.4
6585	Curtains, other furnishings	26.9
6513	Cotton yarn, excl. thread	25.6
	Russia: 1998	
3432	Natural gas, gaseous	47.9
6727	Semi-finished iron, etc., 25%+c	40.0
6831	Nickel, nickel alloy, unwrought	36.4
7187	Nuclear reactors, parts, N.E.S.	29.8
2723	Natural calcium phosphates	23.2
2224	Sunflower seeds	22.5
6726	Semi-finished iron, steel	21.8
2481	Railway, tramway sleepers	20.7
2474	Wood, coniferous, rough, untreated	20.1
6841	Aluminum, aluminum alloy, unwrought	19.9
	Slovak Republic: 1998	
6734	Flat, cold-rolled, producers' iron	3.5
6714	Ferro-manganese	3.3
2112	Whole bovine hide < 8kg dry	3.1
7468	Other ball, roller bearing	2.9
7918	Rail, tram freight cars, etc.	2.9
6611	Quicklime etc., excluding 522.6	2.8
8731	Gas, liquid, electric meters	2.3
6715	Other ferro-alloys	2.1
7912	Other locomotives, tenders	2.1
6732	Flat, hot-rolled, producers' iron	1.9

Table 2.2 (continued)

SITC Code	SITC Definition	Share of World Exports (%)
	Brazil: 1999	
2654	Sisal, agave fibers, waste	78.2
2851	Aluminum ore, concentrate	55.8
4314	Waxes, animal, vegetable origin	48.3
0611	Sugars, beet or cane, raw	39.6
0591	Orange juice	39.5
2815	Iron ore, concentrate, not agglomerates	39.1
4225	Castor oil, fractions	38.0
2816	Iron ore agglomerates	33.5
0176	Bovine meat, prepared, preserved, N.E.S.	29.5
6712	Pig iron, etc., primary form	28.4

Source: Calculations based on International Trade Center, U.N. Statistics Division.
Notes: N.E.S. = not elsewhere specified.

country that was highly dependent on export revenues in any of these industries could have been extremely vulnerable to competitiveness effects from crises in these ground-zero countries.

Table 2.3 lists the calculated values of *Compete*. The first part of the table reports values for each of the fifty-eight countries in the sample for each crisis event. The bottom part of the table lists a number of summary statistics for the entire sample. The values of *Compete* range from almost 0 to 100, with a mean of 5.0 and standard deviation of 9.3. Larger values of *Compete* indicate that a country's economy was more dependent on industries that were most affected by the crisis. The highest value of *Compete* occurs for Singapore during the Korean crisis. Some of the four-digit industries generating this large competitiveness effect are electronic microcircuits; input or output units; storage units for data processing; color television receivers; sound and video recording; parts for telecommunications equipment; and ships, boats, and other vessels. Many of the other large values of *Compete* occur between countries dependent on natural resources and ground-zero countries that export a large quantity of these resources. For example, some of the larger values of *Compete* occur for oil-dependent Oman and Norway during the crises in Russia and Venezuela.

It is also worth noting several trends in *Compete* across crisis events. The average value of *Compete* fluctuates significantly across episodes and is much lower for crises that occur in small countries. For example, the mean value of *Compete* is less than 1 for crises that originate in Ecuador and the Slovak Republic, but more than 12 for the crisis in Korea. *Compete* is also smaller for countries that are less integrated with the rest of the world, even after adjusting for country size. For example, the Indian economy is more than four times larger than the Indonesian economy (as measured by

Table 2.3 **Competitiveness-Effect Statistics**

	Crisis Events															
Country *n*	Mexico 1994	Ecuador 1995	Argentina 1995	Venezuela 1995	Venezuela 1997	Czech Republic 1997	Thailand 1997	The Philippines 1997	Indonesia 1997	Korea 1997	India 1998	Russia 1998	Venezuela 1998	Slovak Republic 1998	Ecuador 1998	Brazil 1999
Argentina	1.69	0.21	—	0.84	1.49	0.52	1.61	0.34	1.48	2.35	2.63	3.25	1.77	0.27	0.35	7.67
Australia	2.43	0.31	2.44	2.06	1.52	1.30	2.88	0.72	6.29	6.28	2.67	7.41	2.03	0.39	0.35	8.34
Austria	8.23	0.11	1.14	0.45	0.41	3.56	4.29	1.41	3.47	11.20	2.63	8.11	0.46	1.25	0.13	4.80
Bangladesh	1.71	0.89	0.98	0.08	0.11	0.93	6.26	1.90	5.97	5.14	9.18	0.95	0.14	0.46	1.28	1.31
Belgium	15.26	0.79	3.39	1.41	1.37	5.99	11.19	2.39	7.32	28.50	19.46	17.85	1.66	3.10	2.14	13.88
Brazil	2.06	0.50	3.46	0.63	0.45	0.55	1.37	0.36	1.47	2.17	1.96	2.65	0.40	0.28	0.13	—
Canada	9.11	0.47	2.14	2.73	3.04	3.30	3.88	1.92	5.89	12.76	1.87	26.29	3.87	1.37	0.65	8.75
Chile	7.48	0.34	2.29	0.53	0.31	0.99	3.68	4.79	19.37	6.34	1.78	15.54	0.37	0.41	0.44	4.72
China	7.46	0.33	2.03	0.87	0.82	2.14	8.24	2.59	6.29	11.80	5.49	3.97	0.99	0.69	0.31	3.16
Colombia	5.38	5.44	0.66	2.45	4.39	0.82	3.34	1.11	6.36	2.86	2.73	6.97	5.02	0.25	4.04	13.13
Croatia	7.24	0.33	2.17	0.66	0.67	2.79	5.36	2.11	5.01	17.71	3.68	4.15	1.06	1.32	0.40	4.44
Cyprus	1.36	0.04	1.55	0.17	0.18	0.53	1.45	0.50	1.09	1.02	1.34	0.46	0.25	0.25	0.05	0.85
Czech Republic	9.05	0.18	2.04	1.35	1.18	—	6.96	1.79	6.10	16.55	4.99	10.80	1.32	2.41	0.20	9.25
Denmark	5.40	0.52	1.72	0.67	0.90	2.33	5.93	1.28	3.78	8.90	3.17	7.11	1.49	0.89	0.75	3.98
Ecuador	17.01	—	3.33	12.52	13.73	0.57	18.10	9.45	21.30	5.29	10.11	20.17	16.99	0.24	—	5.41
Egypt	2.88	0.56	1.06	2.62	2.14	0.42	2.01	0.23	2.94	0.91	3.38	3.44	2.12	0.15	0.29	0.62
Estonia	—	—	—	—	0.99	7.67	14.60	4.33	18.19	17.36	9.21	20.89	1.88	2.94	4.68	—
Finland	6.78	0.35	0.76	0.45	0.42	3.02	3.62	1.67	8.12	17.95	1.56	7.79	0.52	1.59	0.10	6.37
France	4.71	0.12	1.89	0.35	0.32	1.84	3.05	1.04	1.76	8.29	1.79	3.81	0.36	0.74	0.17	3.56
Germany	5.79	0.09	0.99	0.38	0.37	2.27	3.02	0.98	1.70	10.15	2.09	4.47	0.45	0.94	0.12	3.92
Greece	2.14	0.26	1.10	0.39	0.46	0.78	2.55	0.88	2.23	3.46	3.39	1.66	0.50	0.39	0.16	2.00
Hong Kong	5.95	0.07	0.70	0.17	0.15	1.36	7.24	4.28	4.24	12.88	4.58	1.40	0.13	0.38	0.10	0.79
Hungary	7.89	0.13	4.45	0.62	0.66	3.77	6.98	2.08	4.48	11.73	4.33	7.64	0.77	1.87	0.21	8.65
Iceland	2.07	2.12	12.95	2.93	2.08	0.57	24.05	1.39	10.44	12.89	4.91	15.04	2.21	1.02	2.99	5.42
India	1.54	0.42	1.23	0.26	0.25	0.68	5.04	0.83	2.93	3.65	—	1.23	0.29	0.23	0.47	—
Indonesia	7.79	2.18	1.65	5.01	4.35	1.55	14.31	3.47	—	9.58	5.21	16.66	5.96	0.66	2.07	12.65
Ireland	13.00	0.36	4.17	0.64	0.51	4.80	15.15	6.23	4.26	21.60	6.45	12.25	0.57	1.30	0.32	8.64
Israel	3.86	0.13	0.80	0.44	0.21	1.01	7.29	1.39	1.86	6.69	18.89	2.03	0.22	0.38	0.15	1.74
Italy	4.91	0.09	1.16	0.29	0.25	2.43	4.69	1.29	3.17	10.82	3.29	1.81	0.28	0.82	0.16	3.59

Japan	2.87	0.02	0.26	0.11	0.10	0.72	1.81	0.90	0.62	6.95	0.53	1.47	0.13	0.31	0.02	1.28
Korea	7.54	0.10	1.13	0.36	0.38	1.84	6.66	4.08	4.19	—	3.07	2.73	0.49	1.04	0.18	5.57
Malaysia	32.64	1.94	3.36	6.40	5.72	3.71	40.40	17.17	71.43	59.60	5.16	15.30	7.07	1.48	1.67	10.61
Mauritius	6.41	0.70	3.39	1.13	0.46	1.99	45.86	10.77	11.45	14.93	18.29	1.34	0.39	1.08	0.91	70.29
Mexico	—	0.67	1.03	2.65	5.26	2.46	6.70	2.48	5.47	14.49	2.92	10.73	6.71	0.97	1.24	5.82
Morocco	4.45	0.47	1.81	0.19	0.19	0.71	6.04	1.74	3.70	5.81	3.33	7.89	0.26	0.32	0.63	—
The Netherlands	10.54	0.64	3.84	0.98	1.00	3.41	8.94	3.42	5.30	17.60	5.38	17.24	1.20	1.52	1.03	8.70
New Zealand	3.52	0.30	5.17	1.54	1.32	2.30	3.60	0.63	3.10	5.73	2.23	9.44	1.58	0.83	0.35	4.78
Norway	16.18	2.79	3.87	18.16	21.86	1.14	2.92	0.72	13.08	6.92	1.75	69.73	28.16	0.83	3.51	4.09
Oman	50.53	8.59	8.69	57.49	59.71	0.87	1.69	0.76	28.24	4.69	1.53	97.31	78.46	0.39	9.16	—
Peru	3.16	0.67	0.82	0.35	0.78	0.24	1.96	1.57	3.59	5.69	2.27	4.36	0.96	0.09	0.82	4.89
The Philippines	6.15	2.37	0.95	0.35	0.17	1.25	12.69	—	9.53	25.59	4.07	2.13	0.20	0.45	2.23	3.81
Poland	5.82	0.14	1.05	0.67	0.49	3.17	3.80	1.34	4.26	9.64	2.59	5.15	0.53	0.97	0.23	3.79
Portugal	7.64	0.20	0.97	0.25	0.28	2.62	5.27	2.55	5.35	10.76	4.55	1.98	0.34	1.02	0.35	6.42
Romania	5.12	0.09	2.38	1.66	1.02	4.10	5.93	2.35	8.98	12.96	5.37	10.09	1.10	2.18	0.11	5.30
Russia	—	—	—	—	6.82	1.48	1.25	0.48	5.42	4.11	1.19	—	8.39	0.96	0.91	6.79
Singapore	46.04	1.39	3.68	1.18	1.02	6.24	60.04	27.60	23.22	100.00	9.21	15.44	1.06	1.94	0.55	10.93
Slovak Republic	12.08	0.21	3.11	1.96	1.83	6.01	6.72	1.69	6.50	18.81	5.00	21.46	2.56	—	0.24	12.43
Slovenia	14.80	0.21	1.99	1.47	1.09	6.61	9.16	2.49	9.16	21.10	5.48	7.83	1.28	2.69	0.22	8.24
South Africa	2.29	0.07	1.39	0.61	0.94	1.64	3.34	0.92	3.62	4.74	7.29	8.25	0.47	0.56	0.12	6.77
Spain	5.70	0.18	1.20	0.34	0.35	1.76	3.12	0.89	2.01	8.76	2.35	2.92	0.43	0.76	0.32	3.94
Sweden	8.64	0.08	1.16	0.80	0.45	3.35	4.21	1.63	3.29	11.52	2.27	10.20	0.55	1.43	0.16	7.98
Switzerland	4.62	0.07	0.94	0.28	0.26	2.53	4.51	1.20	2.21	8.92	5.35	2.01	0.32	0.79	0.08	3.13
Thailand	10.74	2.14	2.44	0.56	0.48	2.22	—	5.80	17.93	19.09	12.81	4.45	0.93	0.88	2.82	—
Tunisia	14.02	0.86	1.75	3.97	4.21	2.60	9.28	5.20	10.15	9.78	8.59	9.61	4.92	1.19	0.96	2.78
Turkey	4.21	0.11	1.32	0.40	0.35	1.83	3.82	1.59	3.67	7.39	6.47	3.19	0.40	0.61	0.14	2.93
United Kingdom	6.22	0.29	1.02	1.71	1.90	1.79	3.94	1.52	2.69	9.33	2.81	4.66	2.06	0.59	0.29	2.56
United States	1.89	0.04	0.72	0.14	0.13	0.63	1.39	0.64	0.73	3.40	0.66	1.46	0.15	0.23	0.04	1.64
Venezuela	19.27	3.56	3.69	—	—	0.97	1.24	0.20	14.06	2.79	1.37	41.34	—	0.56	3.80	3.73
Summary statistics																
Mean	8.79	0.84	2.28	2.69	2.85	2.26	8.15	2.90	7.90	12.59	4.85	10.97	3.60	0.94	0.99	6.86
Standard Deviation	9.52	1.47	2.08	8.10	8.43	1.72	10.82	4.39	10.45	14.83	4.21	16.12	11.03	0.70	1.57	9.58
Minimum	1.36	0.02	0.26	0.08	0.10	0.24	1.24	0.20	0.62	0.91	0.53	0.46	0.13	0.09	0.02	0.62
Maximum	50.53	8.59	12.95	57.49	59.71	7.67	60.04	27.60	71.43	100.00	19.46	97.31	78.46	3.10	9.16	70.29

Notes: Sample statistics as follows: mean = 4.97; standard deviation = 9.33; minimum = 0.02; maximum = 100.00. Dash indicates data not available.

GDP), but the mean value of *Compete* for the Indian crisis was less than half that for the Indonesian crisis. Both of these characteristics of *Compete* suggest that this variable captures the intuitive prediction that crises in larger and more export-oriented economies would have greater competitiveness effects on other countries.

The other two trade variables used to estimate equation (3) are more straightforward. The income-effect variable (*Income*) is measured as total exports from each country n to the ground-zero country as a percent of country n's GDP. In other words, the income-effect variable for country n during crisis event e can be written

$$Income_{n,e} = \frac{\sum_k \text{Exp}_{n,k,0}}{\text{GDP}_n}, \tag{5}$$

where $\text{Exp}_{n,k,0}$ is exports from country n in industry k to the ground-zero country; and GDP_n is gross domestic product for country n. All variables are measured in U.S. dollars for the one-year period ending before the start of the crisis event e.

Income captures the impact of the crisis on the demand for exports from other countries. Table 2.4 presents the calculated values of *Income.* The first part of the table lists the values for each of the countries in the sample, and the bottom part lists a number of summary statistics. The values of *Income* range from 0 to 15 percent, with a mean of 0.2 and a standard deviation of 0.8. Not surprisingly, countries located in the same geographic region as the ground-zero country tend to be more reliant on exports to the crisis country and therefore to be more vulnerable to any income effect. For example, the largest value of *Income* (15 percent) measures the reliance of the Slovak Republic on exports going to the Czech Republic. The second largest value of *Income* (12 percent) measures exports from Estonia (as a share of GDP) going to Russia.

The final trade variable, the cheap-import effect (*Cheap Import*) is measured as total imports from the ground-zero country into country n as a percentage of consumption and investment in country n.[21] In other words, the cheap-import effect variable for country n during crisis event e can be written

$$Cheap\ Import_{n,e} = \frac{\sum_k \text{Imp}_{n,k,0}}{Consumption_n + Investment_n}, \tag{6}$$

where $\text{Imp}_{n,k,0}$ is imports into country n in industry k from the ground-zero country; and $Consumption_n$ and $Investment_n$ are total private consumption

21. The denominator of this ratio includes private consumption and gross domestic investment in order to focus on the portion of GDP which is most affected by lower import prices. Other components of GDP, such as government consumption and net exports, are less affected by changes in import prices.

Table 2.4 **Income-Effect Statistics**

	Crisis Events															
Country *n*	Mexico 1994	Ecuador 1995	Argentina 1995	Venezuela 1995	Venezuela 1997	Czech Republic 1997	Thailand 1997	The Philippines 1997	Indonesia 1997	Korea 1997	India 1998	Russia 1998	Venezuela 1998	Slovak Republic 1998	Ecuador 1998	Brazil 1999
Argentina	0.11	0.03	—	0.08	013	0.00	0.05	0.02	0.08	0.07	0.07	0.08	0.11	0.00	0.03	2.57
Australia	0.04	0.00	0.01	0.00	0.00	0.01	0.29	0.20	0.45	1.30	0.23	0.02	0.00	0.00	0.00	0.07
Austria	0.05	0.00	0.04	0.01	0.02	0.74	0.08	0.02	0.12	0.13	0.05	0.39	0.02	0.38	0.00	0.12
Bangladesh	0.01	0.00	0.01	0.00	0.00	0.00	0.04	0.03	0.01	0.03	0.06	0.04	0.00	—	0.00	0.03
Belgium	0.16	0.02	0.08	0.03	0.03	0.24	0.31	0.06	0.11	0.19	1.17	0.64	0.04	0.06	0.01	0.34
Brazil	0.19	0.05	0.76	0.05	0.06	0.00	0.05	0.04	0.04	0.11	0.02	0.09	0.09	0.01	0.02	—
Canada	0.14	0.01	0.03	0.08	0.07	0.01	0.07	0.03	0.11	0.34	0.05	0.04	0.11	0.00	0.01	0.16
Chile	0.41	0.17	1.28	0.15	0.21	0.00	0.17	0.15	0.22	1.30	0.10	0.06	0.21	—	0.21	1.05
China	0.04	0.01	0.05	0.01	0.01	0.02	0.15	0.12	0.17	0.92	0.10	0.23	0.01	0.00	0.01	0.11
Colombia	0.13	0.40	0.08	0.67	0.78	0.00	0.01	0.00	0.00	0.03	0.00	0.06	0.91	0.00	0.50	0.10
Croatia	0.00	0.07	0.00	0.00	0.03	0.20	0.01	0.00	0.00	0.00	0.01	0.81	0.00	0.11	0.02	0.00
Cyprus	—	0.00	—	—	—	0.02	0.02	0.00	0.00	0.01	0.01	0.14	—	0.03	0.00	—
Czech Republic	0.04	0.02	0.04	0.01	0.01	—	0.08	0.01	0.03	0.08	0.12	1.46	0.01	5.54	0.02	0.07
Denmark	0.09	0.00	0.05	0.03	0.02	0.10	0.10	0.03	0.08	0.25	0.06	0.50	0.02	0.02	0.01	0.09
Ecuador	0.46	—	0.43	0.05	0.38	0.00	0.00	0.01	0.00	1.65	0.01	0.71	0.25	0.00	—	0.18
Egypt	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.06	0.03	0.00	0.00	—	0.02
Estonia	0.00	—	0.00	0.00	0.00	0.06	0.00	0.07	0.01	0.24	0.06	11.53	0.01	0.02	—	0.00
Finland	0.06	0.01	0.08	0.03	0.03	0.20	0.30	0.12	0.24	0.47	0.20	2.46	0.03	0.05	0.00	0.24
France	0.10	0.00	0.08	0.02	0.02	0.08	0.06	0.03	0.08	0.13	0.06	0.18	0.02	0.03	0.01	0.14
Germany	0.14	0.01	0.06	0.02	0.02	0.39	0.15	0.06	0.11	0.28	0.12	0.45	0.03	0.13	0.01	0.26
Greece	0.02	0.00	0.01	0.00	0.00	0.04	0.04	0.01	0.06	0.04	0.02	0.35	0.00	0.01	0.00	0.06
Hong Kong	0.11	0.00	0.03	0.00	0.00	0.00	0.22	0.21	0.13	0.22	0.03	0.01	0.00	—	0.00	0.04
Hungary	0.01	0.00	0.02	0.01	0.00	0.64	0.03	0.01	0.02	0.03	0.05	2.07	0.00	0.53	0.00	0.18
Iceland	0.00	—	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.10	0.01	0.45	0.00	0.00	—	0.11
India	0.02	0.00	0.01	0.00	0.00	0.01	0.11	0.05	0.15	0.13	—	0.23	0.01	0.00	0.00	0.00
Indonesia	0.08	0.00	0.03	0.01	0.01	0.01	0.36	0.30	—	1.44	0.32	0.04	0.01	0.00	0.01	0.18
Ireland	0.17	0.01	0.06	0.02	0.03	0.18	0.15	0.32	0.04	0.46	0.07	0.44	0.02	0.03	0.01	0.20
Israel	0.10	0.02	0.10	0.03	0.01	0.05	0.35	0.21	0.01	0.38	0.37	0.26	0.02	0.02	0.03	0.30
Italy	0.09	0.01	0.14	0.04	0.04	0.14	0.11	0.03	0.09	0.23	0.09	0.34	0.05	0.06	0.01	0.28
Japan	0.09	0.01	0.01	0.01	0.01	0.00	0.40	0.18	0.20	0.64	0.05	0.02	0.02	0.00	0.01	0.07
Korea	0.32	0.03	0.12	0.02	0.02	0.04	0.51	0.37	0.61	—	0.24	0.37	0.05	0.01	0.02	0.56
Malaysia	0.54	0.01	0.08	0.02	0.02	0.02	3.18	0.93	1.21	2.39	1.18	0.09	0.05	0.00	0.00	0.37

(*continued*)

Table 2.4 (continued)

	Crisis Events															
Country *n*	Mexico 1994	Ecuador 1995	Argentina 1995	Venezuela 1995	Venezuela 1997	Czech Republic 1997	Thailand 1997	The Philippines 1997	Indonesia 1997	Korea 1997	India 1998	Russia 1998	Venezuela 1998	Slovak Republic 1998	Ecuador 1998	Brazil 1999
Malaysia	0.54	0.01	0.08	0.02	0.02	0.02	3.18	0.93	1.21	2.39	1.18	0.09	0.05	0.00	0.00	0.37
Mauritius	0.00	—	0.01	—	—	0.00	0.05	0.01	0.00	0.01	0.33	0.00	—	—	—	0.03
Mexico	—	0.03	0.07	0.05	0.15	0.00	0.03	0.02	0.02	0.10	0.02	0.01	0.23	—	0.05	0.19
Morocco	0.11	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.05	0.03	1.16	0.12	0.02	0.00	0.00	0.00
The Netherlands	0.07	0.01	0.05	0.03	0.02	0.16	0.13	0.07	0.10	0.23	0.13	0.53	0.03	0.07	0.02	0.13
New Zealand	0.22	0.00	0.04	0.10	0.09	0.00	0.28	0.26	0.35	1.03	0.14	0.32	0.11	0.00	0.00	0.14
Norway	0.02	0.00	0.01	0.01	0.01	0.04	0.10	0.06	0.03	0.15	0.05	0.22	0.03	0.01	0.00	0.16
Oman	—	—	0.00	0.00	0.00	—	0.05	0.02	0.00	0.11	0.52	0.15	0.00	—	—	—
Peru	0.33	0.12	0.05	0.17	0.21	0.00	0.06	0.05	0.05	0.24	0.03	0.01	0.22	0.00	0.17	0.29
The Philippines	0.06	0.00	0.01	0.00	0.00	0.00	0.94	—	0.17	0.45	0.04	0.01	0.00	0.00	0.00	0.04
Poland	0.03	0.00	0.02	0.01	0.01	0.58	0.10	0.03	0.03	0.08	0.04	1.49	0.02	0.21	0.00	0.07
Portugal	0.02	0.00	0.07	0.01	0.01	0.02	0.02	0.01	0.00	0.03	0.02	0.07	0.01	0.01	0.00	0.21
Romania	0.02	0.02	0.14	0.01	0.06	0.06	0.13	0.05	0.03	0.14	0.18	0.72	0.07	0.07	0.01	0.02
Russia	0.00	0.00	0.00	0.00	0.00	0.42	0.05	0.03	0.01	0.24	0.21	—	0.00	0.40	0.01	0.06
Singapore	0.29	0.01	0.27	0.04	0.01	0.02	7.76	2.51	—	4.15	2.33	0.78	0.02	0.00	0.00	0.35
Slovak Republic	0.21	0.03	0.08	0.00	0.00	14.58	0.11	0.01	0.12	0.04	0.19	1.69	0.01	—	0.01	0.02
Slovenia	0.01	0.02	0.04	0.01	0.01	0.78	0.04	0.01	0.02	0.05	0.06	1.79	0.02	0.31	0.01	0.08
South Africa	0.03	0.01	0.06	0.02	0.03	0.00	0.10	0.04	0.12	0.47	0.13	0.03	0.05	0.00	0.01	0.13
Spain	0.28	0.01	0.19	0.03	0.04	0.06	0.05	0.02	0.06	0.11	0.04	0.16	0.06	0.02	0.03	0.24
Sweden	0.11	0.01	0.10	0.03	0.03	0.14	0.26	0.10	0.21	0.26	0.13	0.40	0.05	0.04	0.01	0.40
Switzerland	0.15	0.02	0.09	0.03	0.03	0.15	0.25	0.07	0.12	0.32	0.16	0.16	0.04	0.06	0.02	0.32
Thailand	0.08	0.00	0.03	0.00	0.00	0.02	—	0.35	0.53	0.56	0.20	0.08	0.01	0.00	0.00	0.00
Tunisia	0.00	0.00	0.02	0.03	0.00	0.00	—	—	0.08	0.01	0.81	0.02	0.00	0.00	0.00	0.12
Turkey	0.01	0.01	0.02	0.01	0.01	0.05	0.04	0.03	0.03	0.06	0.03	1.08	0.00	0.01	0.00	0.02
United Kingdom	0.06	0.01	0.03	0.03	0.02	0.10	0.13	0.05	0.11	0.18	0.20	0.16	0.03	0.02	0.01	0.11
United States	0.73	0.02	0.06	0.06	0.06	0.01	0.09	0.08	0.05	0.34	0.04	0.04	0.08	0.00	0.02	0.17
Venezuela	0.43	0.25	0.06	—	—	—	0.00	0.00	0.00	0.02	0.01	0.03	—	—	0.34	0.70
Summary statistics																
Mean	0.13	0.03	0.09	0.04	0.05	0.037	0.033	0.13	0.12	0.40	0.21	0.61	0.06	0.17	0.03	0.23
Standard Deviation	0.15	0.07	0.20	0.09	0.12	1.96	1.10	0.36	0.20	0.69	0.40	1.57	0.13	0.78	0.09	0.38
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.73	0.40	1.28	0.67	0.78	14.58	7.76	2.51	1.21	4.15	2.33	11.53	0.91	5.54	0.50	2.57

Notes: Sample statistics as follows: mean = 0.19; standard deviation = 0.78; minimum = 0.00; maximum = 14.58. Dash indicates data not available.

and gross domestic investment, respectively, for country *n*. All variables are measured in U.S. dollars for the one-year period ending before the start of the crisis event *e*.

Cheap Import captures the potential effect of lower import prices in the ground-zero country on the other countries in the sample. Table 2.5 lists the calculated values and summary statistics. Many of the values, including the summary statistics, are similar to those for *Income*.[22] Countries located in the same geographic region as the ground-zero country tend to have higher shares of imports from that country and therefore to be more vulnerable to any cheap-import effects.

2.6 Estimation Results and Sensitivity Tests

Table 2.6 reports results when these measures of *Compete, Income,* and *Cheap Import* are used to estimate the model specified in equation (3).[23] Column (1) reports results when only the trade variables (and no macroeconomic controls) are included in the model. Columns (2) through (7) add a variety of macroeconomic controls that are frequently used in this literature. Column (6) uses the same control variables as the base specification in Glick and Rose (1999), and column (7) includes all of the control variables simultaneously. Each of the trade variables has the predicted sign in table 2.6, although each is not consistently significant across columns. More specifically, the coefficient for the competitiveness effect is always negative and significant at the 1 percent level. The coefficient for the income effect is always negative and significant at the 5 percent level, as long as some macroeconomic controls are included in the specification. The coefficient for the cheap-import effect is always positive, although usually insignificant.

These estimates suggest that not only are the trade effects significant, but their magnitude can be large. Since the point estimates fluctuate across columns, I focus on the estimates in column (2). This specification includes the control variables most frequently cited in the literature, as well as the greatest number of observations (for any specification that includes macroeconomic controls). The point estimate for the competitiveness effect in column (2) is –0.05. This indicates that if a country's competitiveness index was 10 points higher, its abnormal weekly stock return is predicted to be 0.5 percentage points lower, on average, during each week of the crisis. Moreover, since the average length of a crisis in table 2.1 is 2.6 weeks, and the Russian crisis is defined as lasting for 8.0 weeks, the cumulative impact on a country's stock market index could be much greater. A concrete example can help clarify the magnitude of this competitiveness effect. During the Thai crisis, the competitiveness index for Korea was 6.7 and for Malaysia was

22. The correlation between *Income* and *Cheap Import* is 87 percent.
23. The period dummy variables are not reported but are always jointly significant.

Table 2.5 **Cheap-Import Effect Statistics**

	Crisis Events															
Country *n*	Mexico 1994	Ecuador 1995	Argentina 1995	Venezuela 1995	Venezuela 1997	Czech Republic 1997	Thailand 1997	The Philippines 1997	Indonesia 1997	Korea 1997	India 1998	Russia 1998	Venezuela 1998	Slovak Republic 1998	Ecuador 1998	Brazil 1999
Argentina	0.11	0.04	—	0.02	0.05	0.01	0.03	0.01	0.03	0.18	0.05	0.05	0.02	0.01	0.04	2.59
Australia	0.03	0.00	0.02	0.00	0.00	0.01	0.25	0.07	0.40	0.53	0.14	0.00	0.00	0.00	0.00	0.06
Austria	0.04	0.02	0.01	0.00	0.00	0.74	0.07	0.03	0.08	0.13	0.10	0.23	0.00	0.39	0.02	0.10
Bangladesh	0.00	0.00	0.00	—	—	0.00	0.18	0.00	0.17	1.14	3.20	0.24	—	—	0.00	0.13
Belgium	0.14	0.02	0.15	0.06	0.05	0.17	0.33	0.05	0.25	0.17	0.65	0.75	0.07	0.07	0.08	0.76
Brazil	0.08	0.00	0.86	0.13	0.16	0.01	0.03	0.00	0.04	0.19	0.04	0.05	0.16	0.01	0.00	—
Canada	0.78	0.02	0.02	0.09	0.12	0.02	0.17	0.09	0.10	0.45	0.11	0.09	0.15	0.01	0.02	0.19
Chile	0.60	0.42	2.17	0.32	0.50	0.00	0.08	0.03	0.15	0.88	0.10	0.02	0.40	—	0.38	1.52
China	0.02	0.00	0.06	0.01	0.00	0.01	0.27	0.05	0.32	1.77	0.12	0.54	0.00	0.00	0.01	0.14
Colombia	0.45	0.35	0.27	1.53	1.47	0.02	0.02	0.01	0.04	0.21	0.06	0.09	1.66	0.01	0.40	0.57
Croatia	0.02	0.14	0.08	0.00	0.00	1.26	0.03	0.00	0.04	0.20	0.13	2.49	0.02	0.44	0.13	0.39
Cyprus	0.02	0.00	0.41	0.00	0.00	0.10	0.35	0.04	0.27	0.68	0.34	2.13	0.05	0.04	0.00	0.15
Czech Republic	0.02	0.06	0.06	0.00	0.00	—	0.09	0.02	0.09	0.36	0.14	4.03	0.01	4.98	0.03	0.22
Denmark	0.01	0.01	0.20	0.01	0.04	0.10	0.16	0.03	0.14	0.18	0.16	0.22	0.04	0.02	0.00	0.20
Ecuador	1.04	—	0.34	1.10	1.12	0.02	0.01	0.00	0.07	0.39	0.02	0.21	1.75	0.01	—	1.13
Egypt	0.01	0.00	0.19	0.00	0.00	0.07	0.06	0.02	0.16	0.30	0.31	0.53	0.01	0.01	0.00	0.42
Estonia	—	—	—	—	—	-0.51	0.08	0.00	0.14	1.38	0.24	15.01	—	0.28	0.07	—
Finland	0.03	0.03	0.03	0.02	0.01	0.13	0.14	0.06	0.13	0.20	0.09	2.69	0.02	0.05	0.01	0.21
France	0.05	0.01	0.03	0.01	0.02	0.05	0.13	0.03	0.09	0.14	0.10	0.33	0.02	0.02	0.01	0.18
Germany	0.03	0.02	0.06	0.03	0.02	0.41	0.12	0.07	0.12	0.23	0.15	0.60	0.02	0.15	0.02	0.23
Greece	0.01	0.01	0.08	0.01	0.00	0.09	0.07	0.01	0.10	0.55	0.10	0.56	0.00	0.03	0.01	0.09
Hong Kong	0.08	0.00	0.16	0.00	0.01	0.06	2.15	0.67	1.14	7.60	1.29	0.47	0.01	—	0.00	0.37
Hungary	0.01	0.02	0.02	0.00	0.00	1.19	0.06	0.01	0.09	0.36	0.11	4.46	0.00	0.97	0.01	0.44
Iceland	0.01	0.00	0.00	0.00	0.00	0.13	0.09	0.01	0.05	0.40	0.09	0.86	0.00	0.02	0.00	0.04
India	0.01	0.00	0.02	0.00	0.00	0.02	0.05	0.00	0.16	0.24	—	0.17	0.00	0.01	0.00	0.00
Indonesia	0.03	0.00	0.07	0.00	0.01	0.02	0.52	0.04	—	1.14	0.35	0.14	0.00	0.00	0.00	0.26
Ireland	0.03	0.02	0.03	0.00	0.01	0.08	0.50	0.12	0.12	0.77	0.16	0.02	0.01	0.02	0.00	0.09
Israel	0.01	0.01	0.07	0.01	0.00	0.03	0.21	0.01	0.00	0.43	0.35	0.19	0.00	0.00	0.01	0.08
Italy	0.01	0.02	0.09	0.02	0.03	0.08	0.07	0.02	0.10	0.11	0.15	0.47	0.03	0.07	0.02	0.24

Japan	0.03	0.00	0.01	0.01	0.01	0.00	0.25	0.11	0.37	0.39	0.07	0.11	0.01	0.00	0.01	0.08
Korea	0.06	0.09	0.02	0.02	0.01	0.01	0.25	0.12	0.82	—	0.22	0.35	0.01	0.00	0.05	0.28
Malaysia	0.02	0.00	0.12	0.00	0.00	0.01	2.93	0.90	1.61	4.60	0.87	0.42	0.00	0.00	0.00	0.30
Mauritius	0.00	—	0.53	—	—	0.01	0.39	0.08	0.65	0.72	5.70	0.06	—	—	—	0.15
Mexico	—	0.02	0.08	0.08	0.08	0.01	0.08	0.04	0.08	0.34	0.07	0.06	0.14	—	0.02	0.28
Morocco	0.02	0.00	0.27	0.01	0.01	0.04	0.04	0.01	0.08	0.18	0.13	0.62	0.01	0.01	0.00	0.00
The Netherlands	0.05	0.01	0.30	0.10	0.10	0.12	0.40	0.12	0.38	0.29	0.26	0.63	0.06	0.05	0.02	0.57
New Zealand	0.03	0.03	0.04	0.00	0.00	0.01	0.21	0.06	0.26	0.49	0.16	0.01	0.01	0.00	0.05	0.06
Norway	0.03	0.01	0.03	0.02	0.02	0.08	0.09	0.02	0.06	0.18	0.11	0.63	0.05	0.01	0.01	0.20
Oman	0.01	—	0.12	0.00	—	—	—	—	—	—	—	—	—	—	—	—
Peru	0.34	0.33	0.62	0.32	1.01	0.01	0.06	0.00	0.03	0.41	0.04	0.04	0.93	0.00	0.39	0.63
The Philippines	0.04	0.00	0.02	0.02	0.00	0.01	0.82	—	0.88	2.23	0.33	0.59	0.00	0.00	0.00	0.22
Poland	0.01	0.09	0.04	0.00	0.00	0.93	0.08	0.02	0.13	0.54	0.10	2.11	0.00	0.38	0.07	0.19
Portugal	0.09	0.05	0.09	0.02	0.05	0.03	0.12	0.02	0.05	0.34	0.16	0.31	0.07	0.01	0.02	0.57
Romania	0.00	0.03	0.13	0.04	0.20	0.27	0.06	0.00	0.06	1.39	0.08	4.02	0.22	0.21	0.06	0.40
Russia	0.00	0.00	0.00	0.00	0.01	0.15	0.02	0.00	0.03	0.22	0.22	—	0.01	0.08	0.03	0.29
Singapore	0.11	0.00	0.12	0.06	0.08	0.07	10.20	1.98	—	6.42	1.41	0.20	0.04	0.00	0.00	0.32
Slovak Republic	0.03	0.09	0.06	0.00	0.00	16.03	0.08	0.01	0.10	1.14	0.12	8.91	0.00	—	0.06	0.11
Slovenia	0.01	0.09	0.07	0.00	0.00	1.55	0.12	0.01	0.20	0.60	0.12	1.70	0.00	0.70	0.09	0.30
South Africa	0.01	0.00	0.15	0.00	0.00	0.02	0.15	0.02	0.10	0.48	0.29	0.03	0.00	0.00	0.01	0.19
Spain	0.24	0.04	0.17	0.03	0.05	0.04	0.13	0.03	0.21	0.20	0.13	0.29	0.06	0.02	0.04	0.29
Sweden	0.03	0.01	0.03	0.08	0.08	0.11	0.09	0.02	0.10	0.16	0.13	0.27	0.06	0.03	0.00	0.14
Switzerland	0.03	0.01	0.03	0.00	0.00	0.09	0.19	0.02	0.04	0.13	0.15	0.35	0.01	0.04	0.01	0.13
Thailand	0.06	0.00	0.03	0.01	0.01	0.04	—	0.33	0.54	1.55	0.44	0.44	0.02	0.00	0.01	0.00
Tunisia	0.00	0.06	0.33	0.00	0.00	0.11	0.06	0.01	0.07	0.21	0.21	0.69	0.00	0.01	0.04	0.27
Turkey	0.02	0.02	0.04	0.00	0.00	0.06	0.05	0.01	0.09	0.42	0.17	1.22	0.01	0.01	0.02	0.23
United Kingdom	0.05	0.00	0.03	0.03	0.03	0.06	0.20	0.15	0.17	0.35	0.26	0.24	0.03	0.01	0.01	0.15
United States	0.88	0.03	0.03	0.16	0.22	0.01	0.19	0.13	0.14	0.37	0.11	0.07	0.21	0.00	0.03	0.16
Venezuela	0.37	0.02	0.39	—	—	0.00	0.01	0.00	0.01	0.11	0.03	0.00	—	0.00	0.06	0.71
Summary statistics																
Mean	0.11	0.04	0.17	0.08	0.11	0.45	0.42	0.10	0.22	0.82	0.37	1.11	0.12	0.18	0.04	0.35
Standard Deviation	0.22	0.09	0.32	0.26	0.29	2.15	1.41	0.30	0.30	1.40	0.87	2.42	0.35	0.71	0.09	0.42
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.11	0.02	0.00	0.00	0.00	0.00	0.04
Maximum	1.04	0.42	2.17	1.53	1.47	16.03	10.20	1.98	1.61	7.60	5.70	15.01	1.75	4.98	0.40	2.59

Notes: Sample statistics as follows: mean = 0.30; standard deviation = 1.05; minimum = 0.00; maximum = 16.03. Dash indicates data not available.

Table 2.6 **Regression Results**

	Only Trade Variables (1)	Base Specification (2)	Alternate Macroeconomic Controls (3)	(4)	(5)	Glick and Rose (1999) Macroeconomic Controls (6)	Full Set of Macroeconomic Controls (7)
Competitiveness effect	–0.042***	–0.052***	–0.065***	–0.049***	–0.066***	–0.056***	–0.067***
	(0.016)	(0.018)	(0.020)	(0.018)	(0.020)	(0.019)	(0.020)
Income effect	–0.514	–1.021***	–1.136**	–0.964***	–1.256**	–1.095**	–1.243**
	(0.332)	(0.360)	(0.557)	(0.365)	(0.548)	(0.536)	(0.571)
Cheap-import effect	0.083	0.588**	0.446	0.525**	0.566	0.470	0.553
	(0.235)	(0.262)	(0.387)	(0.268)	(0.379)	(0.383)	(0.409)
Private credit growth		–1.536***			–1.779***		–2.373
		(0.535)			(0.535)		(1.788)
Government consumption/GDP		2.718		2.658			6.428
		(2.910)		(3.005)			(4.063)
Current account surplus/GDP		2.754			–0.304	5.133	3.469
		(3.382)			(4.923)	(3.424)	(5.076)
Bank reserves/assets		–1.069		–1.299			0.650
		(1.591)		(1.637)			(2.163)

Private capital inflows/GDP		–0.100		0.564	0.937		0.362
		(0.690)		(0.580)	(1.307)		(1.429)
Domestic credit growth			–1.455**	0.280		0.328	2.142
			(0.687)	(1.106)		(1.275)	(1.728)
Government surplus/GDP			–5.002		–3.375	0.161	1.289
			(4.661)		(4.682)	(4.218)	(5.153)
Money supply (M2)/reserves			1.647		0.759	1.169	0.214
			(1.568)		(1.539)	(1.557)	(2.015)
Openness (total trade/GDP)			1.080**		0.786		0.524
			(0.440)		(0.512)		(0.516)
Growth in GNP per capita				–9.090	–6.823		–6.199
				(6.175)	(7.421)		(7.566)
Inflation (in CPI)				–0.275**		–0.284**	–0.181
				(0.130)		(0.143)	(0.195)
N	796	727	469	727	467	468	460
R^2	0.25	0.27	0.20	0.27	0.22	0.20	0.23

Notes: Standard errors (in parentheses) are White-adjusted for heteroskedasticity. All specifications also include period dummy variables (with the Brazilian crisis as the excluded variable). Variables are defined in the appendix.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

40.4. Therefore, during the one week of the Thai crisis, the competitiveness effect is correlated with a 0.3 percent decline in the Korean stock market and a 2.1 percent decline in the Malaysian market (holding everything else constant).

The point estimate for the second trade variable, the income effect, is –1.02. This implies that if a country's ratio of exports to the crisis country (as a share of GDP) was 1 percentage point higher, its abnormal stock return is predicted to be about 1 percentage point lower, on average, during each week of the crisis. To put these numbers in a more meaningful context, Poland's ratio of exports to Russia during the Russian crisis was 1.5 percent and Finland's ratio was 2.5 percent. Assume that both stock market indices were equal to 100 at the beginning of the Russian crisis, and that these two countries were otherwise identical. By the end of the eight-week Russian crisis, the income effect predicts a decline in the Polish market of about 12 percent and in the Finnish market of about 20 percent. This suggests that small differences in export exposure to a crisis country (such as the 1 percentage point difference between Finland and Poland) can significantly affect a country's vulnerability to a crisis when accumulated over time (an 8 percentage point difference between the two markets).

Potentially counteracting this income effect, however, is the cheap-import effect. The point estimate for the cheap-import effect is 0.59. This implies that if a country's import penetration ratio was 1 percentage point higher, the country's abnormal stock return is predicted to be 0.59 percentage points higher, on average, during each week of the crisis. To put this in context, during the Brazilian crisis the import penetration ratio was 1.5 for Chile and 2.6 for Argentina. According to the regression results, after the one-week Brazilian crisis the cheap-import effect is correlated with an increase in the Chilean and Argentine stock market indexes of 0.9 and 1.5 percentage points, respectively (again holding everything else constant).

Since these trade variables are highly correlated (especially the income and cheap-import effects), it is more meaningful to examine the combined impact of all three variables rather than focus on one effect in isolation. Table 2.7 performs this analysis for the countries and crises discussed above. It estimates the model specified in column (2) of table 2.6 (excluding the country-crisis pairs used for the relevant out-of-sample predictions) and assumes that the stock market index for each country is 100 directly before the crisis.[24] Columns (1) through (3) report the predicted weekly impact on each country's stock market index from each of the trade effects. Column (4) combines these into the total aggregate predicted weekly impact from the trade variables, and column (5) reports the total predicted impact of all the macroeconomic control variables. Column (6) lists the

24. To simplify this comparison, it also assumes that normal returns for each market are zero.

Table 2.7 **Country Examples: Predicted Trade and Macroeconomic Effects**

	Predicted Weekly Trade Effects			Total Predicted Weekly Return			Actual Average Weekly Return
	Competitiveness (1)	Income (2)	Cheap-Import (3)	Trade (4)	Macro Controls (5)	Full Model[a] (6)	(7)
Thai crisis							
Korea	–0.35	–0.52	0.15	–0.72	–0.17	4.53	4.67
Malaysia	–2.11	–3.24	1.72	–3.63	–0.29	1.50	–1.53
Russian crisis							
Finland	–0.41	–2.52	1.58	–1.34	0.70	0.83	–4.43
Poland	–0.27	–1.52	1.24	–0.55	–0.27	0.65	–5.87
Brazilian crisis							
Argentina	–0.40	–2.63	1.53	–1.50	–0.02	–4.61	–5.56
Chile	–0.25	–1.07	0.89	–0.43	–0.07	–3.59	–3.26

Notes: Predicted impact on weekly stock market indices based on out-of-sample coefficient estimates using the model in column (2) of table 2.6.
[a]Full model includes trade and macroeconomic variables, as well as the crisis-specific dummy variables.

model's predicted abnormal weekly returns (the sum of the predicted trade and macroeconomic effects, as well as the crisis-event dummies), and column (7) reports the actual, abnormal weekly stock market return for each country during the given crisis.

The statistics in this table make a number of key points. First, the magnitude of the trade effects can be large. For example, trade linkages during the Thai crisis were predicted to reduce Malaysia's weekly stock return by 3.6 percentage points. Moreover, for longer crises (such as the eight-week Russian crisis) the cumulative impact of these trade effects can be much larger. Second, the predicted impact of the trade variables tends to be larger than the predicted impact of the macroeconomic variables. For example, during the Brazilian crisis the macroeconomic variables predicted virtually no impact on Argentina's stock market index, while the trade variables predicted a decrease of 1.5 percentage points (about one-third of the actual decrease). Third, the simple regression model in equation (3) has only partial success in predicting stock market movements during recent crises. In most of the examples in the table, predicted stock market returns are much lower (in absolute value) than actual returns. This is not surprising, given the fairly low R^2s in table 2.6. On the other hand, the model does fairly well in explaining stock market returns during crises that have more regional than global effects (such as the Thai and Brazilian crises), but does not have as much explanatory power for crises that have greater global effects (such as the Russian crisis).

These central results could be influenced by a number of factors, such as sample selection, variable definitions, and model specification. Therefore, this section closes by describing a number of sensitivity tests. Results are highly robust, so table 2.8 reports only a selection of these estimates.[25] First, I test for the impact of sample selection. I drop one country at a time, one crisis at a time, and the five extreme observations for each variable. Next, since the distribution of *Compete* is skewed to the right, I drop the five largest values for *Compete.* Results are reported in column (2) of table 2.8. Then, since Venezuela and Ecuador have more than one crisis each (which could place too much weight on events in these countries), I include only the first crisis event for each country in the sample. Finally, since many of the extreme values for the competitiveness effect occur in oil-exporting countries during crises in oil-producing regions, I exclude the major oil exporters from the sample. These results are reported in column (3) of table 2.8. In each of these tests, the coefficients on the competitiveness and income effects are negative and significant. The cheap-import effect is always positive, but its significance fluctuates.

As a second series of sensitivity tests, I examine the effect of using alternate variable definitions. I begin by redefining the income effect as exports

25. Full results are available from the author.

Table 2.8 **Sensitivity Tests**

	Base Results (1)	Exclude Outliers for Compete[a] (2)	Exclude Major Oil Exporters[b] (3)	Redefine Income Effect[c] (4)	Add OECD Dummy (5)	Weight Trade Variables[d] (6)	Add Regional Dummies[e] (7)
Competitiveness effect	–0.052***	–0.054**	–0.054***	–0.062***	–0.049**	–0.228**	–0.049***
	(0.018)	(0.022)	(0.021)	(0.018)	(0.018)	(0.104)	(0.017)
Income effect	–1.021***	–1.012***	–1.022***	–0.251***	–1.027***	–0.006**	–1.041***
	(0.360)	(0.356)	(0.376)	(0.097)	(0.359)	(0.003)	(0.358)
Cheap-import effect	0.588**	0.590**	0.597**	0.219	0.607**	–0.468	0.616**
	(0.262)	(0.260)	(0.275)	(0.160)	(0.263)	(1.066)	(0.261)
Private credit growth	–1.536***	–1.546***	–1.633***	–1.383***	–1.407**	–1.491***	–1.783***
	(0.535)	(0.535)	(0.552)	(0.497)	(0.560)	(0.548)	(0.539)
Government consumption/GDP	2.718	2.681	2.955	2.317	2.166	2.957	–2.275
	(2.910)	(2.913)	(3.012)	(2.898)	(2.941)	(2.953)	(4.411)
Current account surplus/GDP	2.754	2.519	2.138	1.710	2.321	1.641	4.012
	(3.382)	(3.398)	(3.924)	(3.351)	(3.440)	(3.350)	(3.627)
Bank reserves/assets	–1.069	–1.008	–0.808	–1.265	–0.769	–0.929	–2.676
	(1.591)	(1.589)	(1.639)	(1.590)	(1.581)	(1.616)	(1.679)
Private capital inflows/GDP	–0.100	–0.078	0.074	–0.256	–0.286	–0.174	–0.052
	(0.690)	(0.690)	(0.727)	(0.688)	(0.698)	(0.694)	(0.756)
OECD dummy					0.371		
					(0.303)		
N	727	722	691	727	727	727	727
R^2	0.27	0.26	0.26	0.27	0.27	0.26	0.28

Notes: Standard errors (in parentheses) are White-adjusted for heteroskedasticity. All specifications also include period dummy variables (with the Brazilian crisis as the excluded variable). Variables are defined in the appendix.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

[a]The five largest values for *Compete* are excluded.

[b]Major oil exporters defined as countries for which the ratio of oil and gas exports to GDP is greater than 5 percent. Countries in the sample that qualify as major oil exporters are Ecuador, Norway, Oman, and Venezuela.

[c]Income effect redefined as exports from country *n* to the crisis country as a percentage of total exports from country *n*.

[d]Trade variables weighted by currency and interest rate movements in the ground-zero country; see text for details.

[e]Regional dummy variables are Africa, Australasia, Central and South Asia, East Asia, former communist Europe (including Russia), Central and South America, North America, and Western Europe. The excluded region is the Middle East.

from country *n* to the crisis country as a share of total exports from country *n* (instead of as a share of country *n*'s GDP). Then I recalculate the cheap-import effect as imports into country *n* from the crisis country as a share of total imports into country *n* (instead of the sum of consumption and investment in country *n*). Finally, I use normal returns instead of abnormal returns for the dependent variable. (In other words, I no longer subtract each country's average stock market return for the year preceding the crisis.) The first set of results is reported in column (4) of table 2.8. The coefficients for the competitiveness and income effects remain negative and significant in each of these tests.

As a third set of robustness tests, I estimate a number of variations to the base specification. Since there is no reason to believe that the relationship between the trade variables and the stock returns is linear, I include logarithmic, squared, and/or cubed terms for each of the trade variables. In most cases, the linear model outperforms the extended models, although there is weak evidence that the income effect may decrease at higher values. Next, I add a number of additional control variables, such as GDP, GDP per capita, an OECD dummy, and an oil-exporter dummy. Then, since different crises are driven by different combinations of currency and interest rate movements (a question investigated in more depth in the next section), I weight each of the trade variables by the change in the relevant variable in the ground-zero country.[26] Finally, since the trade variables (especially the income and cheap-import effects) may be capturing regional effects, I add a series of detailed regional-dummy variables to the base specification. A sample of these results is reported in columns (5) through (7) of table 2.8. In each case, the coefficients for the competitiveness and income effects remain negative and significant. Moreover, it is worth emphasizing the results in the last column that include the regional dummy variables. These regional dummy variables are jointly significant and several are individually significant. Even after controlling for these regional effects, however, the competitiveness and income effects are still negative and highly significant. This suggests that the trade variables are not simply capturing regional effects, such as financial linkages or regional learning.

As a final series of sensitivity tests, I change the definition of a crisis used in equation (2); more specifically, I use two less-stringent criteria for an event to qualify as a crisis. First, I define a crisis as any week for any country in the sample in which

$$\text{EMP}_{nt} > \mu_{\text{EMP}} + 3\sigma_{\text{EMP}}. \tag{7}$$

The resulting sample of crisis events is listed in table 2.9. There are now twenty-seven crises (versus sixteen in the base analysis), lasting an average

26. More specifically, I weight *Compete* and *Cheap Import* by the percent change in the ground-zero country's exchange rate, and I multiply *Income* by the percent change in the ground-zero country's interest rate spread. Data sources and variable definitions are described in section 2.4.

Table 2.9 **Alternate Crisis Events: Crises Defined as $EMP_{nt} > \mu_{EMP} + 3\sigma_{EMP}$**

Country	Crisis Event Dates
Mexico	11/28/94–01/08/95, 01/16/95, 02/27/95–04/02/95, 10/30/95–11/12/95
Ecuador (1)	01/23/95–02/12/95, 10/30/95–11/05/95, 11/27/95–12/03/95, 12/18/95–12/24/95
The Philippines (1)	02/20/95–02/26/95
Argentina	02/27/95–03/12/95
South Africa (1)	04/17/95–04/23/95, 02/12/96–02/18/96, 04/01/96–04/14/96
Colombia	12/04/95–12/10/95
Venezuela (1)	12/11/95–12/17/95, 12/25/95–12/31/95, 04/15/96–04/21/96
South Africa (2)	04/15/96–04/28/96
Ecuador (2)	07/01/96–07/07/96
Venezuela (2)	03/10/97–03/16/97, 05/12/97–05/18/97, 05/26/97–06/02/97, 11/10/97–11/16/97, 02/16/98–02/22/98
Czech Republic	05/19/97–06/01/97
Slovak Republic (1)	05/19/97–06/08/97
Thailand	06/30/97–07/06/97, 12/08/97–12/14/97, 12/29/97–01/04/97
The Philippines (2)	07/07/97–07/13/97, 09/29/97–10/05/97, 12/08/97–12/14/97
Indonesia	08/11/97–08/31/97, 09/29/97–10/05/97, 12/08/97–12/14/97, 01/05/98–01/11/98, 01/19/98–01/25/98, 02/09/98–02/22/98, 03/02/98–03/08/98, 03/30/98–04/05/98, 04/13/98–04/19/98, 05/04/98–05/10/98, 05/18/98–05/24/98, 06/08/98–06/14/98
Brazil (1)	10/27/97–11/30/97, 12/15/97–12/21/97, 09/07/98–09/27/98
Russia (1)	11/17/97–11/23/97, 05/18/98–05/23/98, 07/06/98–07/13/98, 08/10/98–09/20/98
Korea	12/01/97–12/14/97, 12/29/97–01/04/97
India	01/19/98–01/25/98
Malaysia	03/02/98–03/08/98
Venezuela (3)	04/20/98–04/26/98, 06/15/98–06/21/98, 09/14/98–09/20/98
South Africa (3)	06/22/98–06/28/98
Slovak Republic (2)	09/14/98–10/04/98, 05/17/99–05/23/99
Ecuador (3)	09/21/98–09/27/98, 10/19/98–10/25/98, 11/02/98–11/08/98, 01/11/99–01/17/99, 01/25/99–02/07/99, 02/22/99–03/07/99
Norway	12/07/98–12/13/98
Russia (2)	12/28/98–01/03/99
Brazil (2)	01/11/99–01/24/99, 02/22/99–02/28/99

Note: See notes to table 2.1 for a full list of countries included in the sample.

of 4.0 weeks (versus an average of 2.6 weeks in the base analysis). Second, I redefine a crisis as any week in which

$$\text{EMP}_{nt} > \mu_{\text{EMP}} + 1.5\sigma_{\text{EMP}}. \tag{8}$$

The resulting fifty-seven crisis events are listed in table 2.10, with the average crisis lasting 5.3 weeks. Finally, I reestimate the model in equation (3) using these larger samples of crisis events. Results for three different specifications are reported in table 2.11. The competitiveness and income effects remain negative and significant in each specification, and the bargain effect remains positive (with fluctuating significance).

To conclude, this series of sensitivity tests suggests that the competitiveness and income effects are negative, significant, and robust. The cheap-import effect is generally positive, although its significance varies across specifications. These trade effects can be large and economically important determinants of a country's vulnerability to a crisis that originates elsewhere in the world. It is worth emphasizing, however, that this simple model does not explain most of the variation in countries' stock market returns. The R^2s range from about 0.20 to 0.28 for the various specifications in tables 2.6 and 2.8, and the trade and macroeconomic variables often underpredict stock market movements in the comparisons in table 2.7. Therefore, although trade linkages (and macroeconomic variables) are important, they are clearly not the only factors affecting a country's stock market returns. Other factors, such as financial linkages or changes in investor sentiment, may also be important determinants of country's vulnerability to financial crises.

2.7 Do Different Types of Crises Generate Different Trade Effects?

The previous analysis used an exchange-market pressure index, which incorporated changes in exchange rates, interest rates, and reserve levels, to define a series of crises from 1994 through 1999. There are, however, significant differences across these crises, especially in the relative importance of each component of the EMP index. Many of these crises, such as those in Mexico and Thailand, involved substantial currency devaluations. During other crises, such as in Argentina, the currency's value remained fairly stable and the government responded by raising interest rates and paying international reserves.

Moreover, the way a country responds to increased pressure on its exchange rate could determine how the crisis is transmitted to other countries. For example, if a crisis includes a large currency devaluation, then exports from the crisis country will become relatively cheaper on international markets and the crisis could spread through competitiveness and cheap-import effects. On the other hand, if the currency's value remains fixed, there should not be significant competitiveness or cheap-

Table 2.10 **Alternate Crisis Events: Crises Defined as $EMP_{it} > \mu_{EMP} + 1.5\sigma_{EMP}$**

Country	Crisis Event Dates
Slovak Republic (1)	07/18/94–07/24/94
Poland	09/12/94–09/18/94
India (1)	09/19/94–09/25/94, 10/03/94–10/30/94, 12/05/94–12/25/94
Mexico (1)	11/07/94–01/08/95, 01/16/95–01/29/95, 02/20/95–04/02/95, 04/10/95–04/16/95, 10/30/95–11/12/95
Argentina	12/19/94–12/25/94, 02/27/95–03/26/95
Thailand (1)	01/09/95–01/15/95
Ecuador (1)	01/23/95–02/19/95, 09/18/95–09/24/95, 10/23/95–11/05/95, 11/13/95–12/03/95, 12/18/95–12/31/95
Venezuela (1)	01/30/95–02/05/95, 12/11/95–12/17/95, 12/25/95–12/31/95
The Philippines (1)	02/20/95–03/12/95, 03/20/95–04/09/95
South Africa (1)	03/27/95–04/23/95, 01/29/96–03/03/96
Austria	05/08/95–05/14/95
Belgium	05/08/95–05/14/95
Norway (1)	05/08/95–05/14/95
Switzerland	05/08/95–05/14/95
India (2)	10/16/95–10/22/95, 10/30/95–11/05/95, 12/25/95–12/31/95, 01/29/95–02/04/96, 02/19/96–02/25/96, 03/04/96–03/10/96
Colombia (1)	11/27/95–12/24/95, 02/05/96–02/11/96, 02/26/96–03/03/96
South Africa (2)	03/25/96–04/28/96, 07/08/96–07/14/96, 07/22/96–07/28/96
Venezuela (2)	04/15/96–04/21/96, 03/10/97–03/16/97
Greece (1)	05/20/96–05/26/96, 11/25/96–12/01/96, 12/16/96–12/22/96
Ecuador (2)	07/10/96–07/07/96
New Zealand	01/20/97–01/26/97
Thailand (2)	02/03/97–02/09/97, 06/30/97–07/06/97, 07/28/97–08/03/97, 08/11/97–08/24/97, 11/10/97–11/16/97, 12/08/97–12/14/97, 12/29/9701/11/97
Colombia (2)	02/24/97–03/02/97, 12/22/97–12/28/97
Slovak Republic (2)	03/24/97–04/20/97, 05/19/97–06/08/97
Russia (1)	04/07/97–04/13/97, 10/13/97–10/19/97, 10/27/97–11/02/97, 11/10/97–11/17/97, 12/01/97–12/14/97
Czech Republic	05/12/97–06/10/97, 11/24/97–11/30/97
Venezuela (3)	05/12/97–06/01/97, 11/10/97–11/16/97, 01/19/98–01/25/98, 02/16/98–02/22/98, 04/20/98–04/26/98
The Philippines (2)	06/30/97–07/13/97, 07/21/97–07/27/97, 08/25/97–08/31/97, 09/29/97–10/05/97, 12/08/97–12/14/97, 12/22/97–12/28/97, 06/08/98–06/14/98
Malaysia	07/07/97–07/20/97, 12/08/97–12/14/97, 12/29/97–01/11/98, 01/19/98–01/25/98, 03/02/98–03/08/98

(*continued*)

Table 2.10 (continued)

Country	Crisis Event Dates
Indonesia (1)	07/14/97–07/20/97, 08/11/97–09/21/97, 09/29/97–10/05/97, 10/13/97–10/19/97, 11/03/97–11/23/97, 12/01/97–12/14/97, 12/29/97–01/11/98, 01/19/98–01/25/98, 02/09/98–02/22/98, 03/02/98–03/08/98, 03/30/98–04/05/98, 04/13/98–04/19/98, 05/04/98–05/10/98, 05/18/98–05/31/98, 06/08/98–06/14/98, 06/22/98–06/28/98
Greece (2)	09/15/97–09/21/97, 10/27/97–11/02/97, 08/10/98–08/16/98
Australia (1)	10/20/97–10/26/97, 07/20/98–07/26/98
Mexico (2)	10/20/97–10/26/97, 08/17/98–09/13/98, 09/28/98–10/04/98
Brazil (1)	10/27/97–12/28/97, 08/31/98–10/25/98
Korea (1)	11/17/97–12/21/97, 12/29/97–01/04/97, 03/30/98–04/05/98
Chile (1)	11/24/97–12/07/97, 12/15/97–12/28/97
Norway (2)	11/24/97–12/28/97
Ecuador (3)	12/01/97–12/14/97, 12/22/97–12/28/97, 03/30/98–04/05/98, 05/11/98–05/17/98, 08/03/98–08/23/98, 08/31/98–09/13/98, 09/21/98–09/27/98, 10/19/98–11/22/98
Singapore	12/08/97–12/14/97, 01/05/98–01/11/98
India (3)	01/12/98–01/25/98
Colombia (3)	03/30/98–04/12/98, 06/01/98–06/07/98, 08/31/98–09/13/98, 10/05/98–10/11/98
Russia (2)	04/27/98–05/04/98, 05/18/98–05/31/98, 07/06/98–07/12/98, 08/10/98–09/20/98, 10/12/98–10/18/98, 12/28/98–01/03/99
South Africa (3)	05/25/98–05/31/98, 06/08/98–07/05/98, 08/03/98–08/09/98, 08/24/98–08/30/98, 09/28/98–10/04/98
Venezuela (4)	06/15/98–06/21/98, 09/14/98–09/20/98, 11/30/98–12/06/98
Indonesia (2)	07/20/98–07/26/98, 08/03/98–08/16/98, 11/02/98–11/08/98
The Philippines (3)	08/03/98–08/09/98
Canada	08/17/98–08/30/98
Slovak Republic (3)	08/17/98–08/23/98, 09/14/98–10/04/98, 05/10/99–05/23/99
Israel	10/05/98–10/11/98
Australia (2)	10/19/98–10/25/98
Japan	10/19/98–10/25/98, 11/02/98–11/08/98
Brazil (2)	10/26/98–11/08/98, 01/11/99–01/24/99, 02/22/99–02/28/99
Ecuador (4)	11/30/98–12/13/98, 01/11/99–02/14/99, 02/22/99–03/07/99, 03/15/99–03/21/99, 03/29/99–04/04/99
Norway (3)	11/30/98–12/13/98, 12/21/98–12/27/98, 06/21/99–06/27/99
Chile (2)	12/07/98–12/13/98, 12/21/97–12/27/97, 06/14/99–06/20/99
Korea (2)	12/21/98–12/27/98
Peru	01/04/99–01/10/99

Table 2.11 Regression Results: Alternate Crisis Definitions

	Crises Defined As $EMP_{nt} > \mu_{EMP} + 3\sigma_{EMP}$			Crises Defined As $EMP_{nt} > \mu_{EMP} + 1.5\sigma_{EMP}$		
	Base Specification	Alternate Macroeconomic Controls	Full Set of Macroeconomic Controls	Base Specification	Alternate Macroeconomic Controls	Full Set of Macroeconomic Controls
Competitiveness effect	–0.056***	–0.053**	–0.054**	–0.065**	–0.089**	–0.091**
	(0.020)	(0.024)	(0.023)	(0.033)	(0.039)	(0.040)
Income effect	–0.927***	–1.067**	–1.216**	–0.671***	–0.724***	–0.744***
	(0.334)	(0.489)	(0.511)	(0.203)	(0.214)	(0.215)
Cheap-import effect	0.582**	0.698	0.816	0.353**	0.344**	0.359**
	(0.276)	(0.406)	(0.423)	(0.145)	(0.163)	(0.165)
Private credit growth	–0.092		–1.641	–0.110		0.191
	(0.604)		(1.314)	(0.330)		(0.945)
Government consumption/GDP	3.642		7.693**	–2.476		0.102
	(2.218)		(3.358)	(1.393)		(2.100)
Current account surplus/GDP	3.969		5.481	–0.716		–0.372
	(2.493)		(3.419)	(1.703)		(2.278)
Bank reserves/assets	1.185		2.360	–1.859**		–0.236
	(1.185)		(1.614)	(0.837)		(1.105)
Private capital inflows/GDP	0.137		0.409	0.161		–0.379
	(0.437)		(0.859)	(0.315)		(0.623)
Domestic credit growth		–0.459	1.438		0.087	–0.131
		(0.938)	(1.295)		(0.757)	(0.781)
Government surplus/GDP		–2.163	2.552		6.354**	6.792**
		(2.895)	(3.283)		(2.868)	(3.424)

(*continued*)

Table 2.11 (continued)

	Crises Defined As $EMP_{nt} > \mu_{EMP} + 3\sigma_{EMP}$			Crises Defined As $EMP_{nt} > \mu_{EMP} + 1.5\sigma_{EMP}$		
	Base Specification	Alternate Macroeconomic Controls	Full Set of Macroeconomic Controls	Base Specification	Alternate Macroeconomic Controls	Full Set of Macroeconomic Controls
Money supply (M2)/reserves		0.450	–0.169		2.169**	2.209**
		(1.399)	(1.618)		(0.886)	(1.081)
Openness (total trade/GDP)		0.256	–0.314		0.436**	0.520**
		(0.305)	(0.369)		(0.216)	(0.249)
Growth in GNP per capita		–0.674	1.417		1.605	1.477
		(5.699)	(6.212)		(3.394)	(3.604)
Inflation (in CPI)		0.023	0.007		–0.038	–0.036
		(0.146)	(0.175)		(0.087)	(0.131)
N	1,245	809	797	2,657	1,726	1,707
R^2	0.12	0.13	0.14	0.24	0.25	0.26

Notes: Standard errors (in parentheses) are White-adjusted for heteroskedasticity. All specifications also include period dummy variables (with the Brazilian crisis as the excluded variable). Variables are defined in the appendix.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

Table 2.12 Crisis Subgroups

With Weekly Currency Devaluation[a] ≥ 10%	With Weekly Interest Rate Increase[b] ≥ 30%
Mexico	Mexico
Venezuela (1)	Ecuador (1)
Thailand	Argentina
The Philippines	Venezuela (2)
Indonesia	Czech Republic
Korea	The Philippines
Russia	Indonesia
Ecuador (2)	India
Brazil	Russia
	Venezuela (3)
	Slovak Republic
	Ecuador (2)

Notes: Based on the crisis events listed in table 2.1.

[a]Devaluation/depreciation measured as the nominal exchange rate based on U.S. dollars. See section 2.4 for further information.

[b]Interest rates are short-term and based on the difference between the spread with the short-term U.S. interest rate versus the same spread averaged over the previous year. See section 2.4 for further information.

import effects. Similarly, if the crisis includes a large increase in interest rates, this is likely to slow investment and growth in the crisis region. This could lead to a larger income effect than if interest rates were left unchanged or decreased.

To test whether differences across crises determine how they impact other countries, I divide the sample of crises identified in table 2.1 into two subgroups. The first subgroup is any crisis that includes a currency devaluation of 10 percent or more during at least one week of the crisis. The second subgroup is any crisis that includes an increase in the interest rate spread of 30 percent or more during at least one week of the crisis.[27] The crises that qualify in these subgroups are listed in table 2.12. As shown in the table, slightly more than half of the crises include a major currency devaluation, and three-fourths of the crises include a major increase in interest rates.

Next, I reestimate equation (3) for each of these crisis subgroups, using the same methodology, definitions, and specification as the base results reported in section 2.6. Table 2.13 reports results. Column (1) repeats estimates for the entire sample of sixteen crises. Columns (2) and (3) report results for crises that include and do not include, respectively, a major currency devaluation. Columns (4) and (5) report results for crises that in-

27. Both statistics are calculated as described in section 2.4. More specifically, the exchange rate is calculated as the nominal U.S. dollar exchange rate. The interest rate is calculated as the short-term interest rate spread (versus the U.S. rate) less the same spread averaged over the previous year.

Table 2.13 Regression Results Based on Crisis Subgroups

		Crisis Events			
	Full Sample (1)	With a Major Devaluation[a] (2)	With No Major Devaluation[a] (3)	With a Major Interest Rate Increase[b] (4)	With No Major Interest Rate Increase[b] (5)
Competitiveness effect	–0.052***	–0.047***	–0.050	–0.049**	–0.047
	(0.018)	(0.018)	(0.078)	(0.024)	(0.032)
Income effect	–1.021***	–0.845	–1.344**	–1.030***	–0.578
	(0.360)	(0.449)	(0.638)	(0.342)	(1.137)
Cheap-import effect	0.588**	0.310	1.015	0.633**	0.065
	(0.262)	(0.293)	(0.573)	(0.248)	(0.913)
Private credit growth	–1.536***	–0.978	–2.165***	–1.967***	–0.041
	(0.535)	(0.787)	(0.839)	(0.599)	(1.138)
Government consumption/GDP	2.718	7.137**	–2.548	0.242	9.168
	(2.910)	(3.105)	(5.404)	(3.289)	(6.188)
Current account surplus/GDP	2.754	5.667	–2.733	2.627	0.375
	(3.382)	(3.738)	(6.421)	(3.838)	(7.005)
Bank reserves/assets	–1.069	2.096	–5.507	–2.640	4.003
	(1.591)	(1.762)	(3.068)	(1.778)	(3.219)
Private capital inflows/GDP	–0.100	0.598	–0.589	–0.675	3.666**
	(0.690)	(0.680)	(1.281)	(0.746)	(1.770)
N	727	406	321	556	171
R^2	0.27	0.26	0.28	0.27	0.25

Notes: Standard errors (in parentheses) are White-adjusted for heteroskedasticity. All specifications also include period dummy variables (with the Brazilian crisis as the excluded variable). Variables are defined in the appendix.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

[a]Major devaluation defined as an increase in the nominal U.S. dollar exchange rate of at least 10 percent within at least one week of the crisis. See table 2.12 for the crisis list.

[b]Major interest rate increase defined as an increase of at least 30 percent within at least one week of the crisis in the short-term interest rate spread (compared to the U.S. rate) less the average spread over the past year. See table 2.12 for the crisis list.

clude and do not include, respectively, a major increase in interest rates. Most of the estimates in table 2.13 support the predictions discussed above. The competitiveness effect is negative and highly significant during crises that include a major devaluation, but highly insignificant during crises that do not include a major devaluation. The income effect is negative and highly significant during crises that include a major increase in interest rates, but is highly insignificant during crises that do not include a major increase in interest rates. Estimates for the cheap-import effect are generally insignificant and are the only coefficients that do not follow the above predictions. This is not surprising, however, given the general lack of robustness for this coefficient.

These results have an important implication. When a country's exchange

rate is under pressure during a crisis, the country's response is a critical determinant of how the local crisis affects the rest of the world. If the country responds by devaluing its currency (or allowing its currency to depreciate), then other countries that compete with the crisis country's exports will be affected by the change in relative export prices. On the other hand, if the country responds by raising interest rates, this will directly affect countries that export to the crisis country, probably through a contraction in income and investment. Therefore, the way a country responds to a crisis is an important determinant of how that crisis affects other economies.

2.8 Summary and Conclusions

This paper analyzed whether trade linkages were important determinants of a country's vulnerability to currency crises. It began by discussing previous empirical work on this subject in some detail. Most of these papers use aggregate data on bilateral trade flows between countries. Results are mixed. Some papers argue that trade linkages are important determinants of a country's vulnerability to a crisis, whereas others argue that trade is not important, especially in the transmission of recent currency crises. A serious limitation of this macro-level work is that the trade data are not disaggregated by industry, and therefore do not accurately measure competition in third markets. Moreover, many of these papers could suffer from omitted-variables bias since trade flows are highly correlated with other cross-country linkages, such as financial flows, that are extremely difficult to measure.

Next, this paper surveyed several theoretical papers that explain how trade could transmit crises internationally. More specifically, it explained that "trade" incorporates three distinct channels: a competitiveness effect, an income effect, and a cheap-import effect. A competitiveness effect occurs when one country devalues its currency, increasing the relative competitiveness of its exports and hurting the competitiveness of exports from other countries. An income effect occurs when a crisis affects income and growth within the crisis country, thereby affecting (and probably reducing) purchases of imports from abroad. A cheap-import effect occurs when a country devalues its currency, reducing the relative price of its exports and thereby reducing prices in countries that import these goods. Although each of these three trade linkages could transmit a crisis internationally, these various effects may not all work in the same direction. For example, the income effect could partially counteract the cheap-import effect. Therefore, when measuring the importance of trade linkages, it is necessary to isolate each of these effects and measure them independently.

This was the paper's main goal. It attempted to measure the significance and magnitude of each of these three trade linkages in countries' vulnerability to recent crises. To do this, it used trade flow data between most countries in the world, disaggregated at the four-digit industry level. By using

industry-level data, the paper was able to measure competition in third markets more accurately than past work on this subject. In order to perform this analysis, the paper constructed a number of statistics measuring the importance of trade linkages during the sixteen most severe crises between 1994 and 1999. The most interesting statistic was the competitiveness variable, which measured the importance of the crisis country to each export industry as well as how dependent other countries were on those industries.

Estimation results suggested that trade linkages were highly significant determinants of a country's vulnerability to recent crises. Countries that competed in the same industries as major exports from the crisis country had significantly lower stock market returns during these crises. Countries that had a larger share of exports going to the crisis countries also had significantly lower stock returns. These competitiveness and income effects remained both highly significant and economically important across an extensive series of sensitivity tests, including less stringent definitions of what constitutes a crisis. Although estimates of the third trade effect (the cheap-import effect) usually had the expected sign, its significance fluctuated across these sensitivity tests. Countries that had a larger share of imports from the crisis country had slightly higher stock returns during these events. Taken as a whole, these results suggest that trade linkages were highly significant determinants of a country's abnormal stock returns during recent currency crises.

Another series of results from this empirical analysis concerned the magnitude and relative importance of trade and other macroeconomic variables in explaining different countries' vulnerability to financial crises. Although trade and macroeconomic variables were significant and economically important, these variables explain only a portion of stock market movements. For example, in the base regression results, trade and macroeconomic variables explained about one-fourth of the variation in countries' abnormal stock returns during recent crises. Three-fourths of the variation is therefore not explained in this simple model. This suggests that other factors, such as financial linkages and investor behavior, may also be important. Estimates also suggested that the impact of trade linkages was greater in magnitude than that of a country's macroeconomic characteristics.

A final empirical result is that the importance of these trade linkages depends on the way the crisis country responded to pressure on its exchange rate. When a country responded by devaluing its currency (or allowing it to depreciate), the competitiveness effect was negative and highly significant. When the country maintained a relatively stable exchange rate, there was no significant competitiveness effect. On the other hand, when a country responded to exchange-market pressure by raising interest rates substantially, the income effect was negative and highly significant. If the country kept interest rates fairly steady (or raised them by only a small amount), there was no significant income effect. Therefore, the way a country responded to pressure on its exchange rate was a significant determinant of how the cri-

sis affected other countries and, in particular, which trade linkages were important.

This series of results has important implications for the role of international institutions in responding to future financial crises. Real linkages between countries, such as trade, are important determinants of how a crisis spreads internationally. Multilateral assistance or bailout packages will have limited success in reducing these cross-country linkages. On a more positive note, however, multilateral institutions could provide a crisis country with a wider variety of options (with respect to exchange rate and interest rate policy) than would otherwise be available. Therefore, even though multilateral institutions could not prevent the inevitable transmission of a crisis through these trade linkages, they might influence how the country responds to any exchange-market pressure and therefore influence which countries are most affected by the crisis.

Appendix

Data Sources and Definitions

Data to Calculate the Exchange-Market Pressure Index

1. *Nominal exchange rates.* Exchange rates expressed as the local currency per U.S. dollar as reported by Datastream.
2. *Short-term interest rates.* As reported by Datastream. The short-term rate is measured by the interbank rate (preferred) or the call rate. If neither of these is available, then the shortest-term rate available is used. The U.S. interest rate is the Federal Fund's rate.
3. *International reserves to the money supply.* The ratio of total international reserves less gold divided by narrow money (M1). Reserve data are from line 1L.dzf, and M1 data are from 34..zf from the International Financial Statistics (IMF 2000). Weekly data are interpolated from the monthly data.
4. *Inflation.* Annual percentage change in consumer prices. Data are from line 64.xzf from IMF (2000).

Data to Calculate the Trade-Effect Regressions

1. *Stock market returns.* Based on stock market indices in U.S. dollars as reported by Datastream. Abnormal returns are calculated as the weekly stock return during the given time period minus the average weekly return (i.e., normal return) for the previous year. Calculation of the normal return excludes one week prior to the start date for the calculation of the abnormal return, in order to exclude any unusual market movements directly before a crisis.

2. *Competitiveness effect.* The weighted product of two terms: exports from the ground-zero country in a given industry as a share of global exports in that industry; and total exports from country *n* in the same industry, as a share of country *n*'s GDP. These products are summed across industries for each country-crisis pair and weighted by the maximum calculated value (and multiplied by 100). This creates an index that can take values from 0 to 100. All trade data are in U.S. dollars and are reported by the International Trade Center, UN Statistics Division (1999).

3. *Income effect.* Calculated as the ratio of total exports to the ground-zero country as a share of GDP. Export data are from the International Trade Center, UN Statistics Division (1999). GDP is reported in the World Development Indicators (World Bank 2000).

4. *Cheap-import effect.* Calculated as the ratio of total imports from the ground-zero country to the sum of private consumption and gross domestic investment. Private consumption is the market value of all goods and services, including durable products purchased or received as income in kind by households, but excluding purchases of dwellings. Gross domestic investment consists of outlays on additions to the fixed assets of the economy, plus net changes in the level of inventories. Import data are from the International Trade Center, UN Statistics Division (1999). Statistics in the denominator are reported in World Bank (2000).

5. *Private credit growth.* Average annual growth in credit to the private sector. This excludes credit to governments and public enterprises. Data are from line 32d..zf of IMF (2000).

6. *Government consumption/GDP.* The ratio of general government consumption to GDP as reported in the World Bank (2000). General government consumption includes all current spending for purchases of goods and services (including wages and salaries). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation.

7. *Current account surplus/GDP.* The current account balance as a percentage of GDP, where a positive value indicates a surplus. Data are from World Bank (2000).

8. *Bank reserves/assets.* The ratio of domestic currency holdings and deposits with the monetary authorities to claims on other governments, nonfinancial public enterprises, the private sector, and other banking institutions. Reported in World Bank (2000).

9. *Private capital inflows/GDP.* The ratio of gross private capital flows to GDP as reported in World Bank (2000). Gross private capital flows are the sum of the absolute values of direct, portfolio, and other investment inflows and outflows recorded in the balance of payments financial account, excluding changes in the assets and liabilities of monetary authorities and general government. The indicator is calculated as a ratio to GDP converted to international dollars using purchasing power parities.

10. *Domestic credit growth.* Average annual growth in domestic credit. Data are from line 32..zf of IMF (2000).

11. *Government surplus/GDP.* The government budget surplus as a percentage of GDP, where a positive value indicates a surplus. The government budget surplus is from line 80 of IMF (2000), and GDP data are from World Bank (2000).

12. *Money supply/reserves.* The ratio of money and quasi money (M2) to gross international reserves as reported the World Bank (2000). Money and quasi money is the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government (which corresponds to the sum of lines 34 and 35 of IMF 2000). Gross international reserves are holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of the monetary authorities.

13. *Openness.* The ratio of total trade to GDP. Total trade is calculated as the sum of all imports and exports as reported by the International Trade Center, UN Statistics Division (1999). GDP is reported in World Bank (2000).

14. *Growth in GNP per capita.* Average annual growth in gross national product (GNP) per capita. Data taken from World Bank (2000).

15. *Inflation.* Domestic consumer price index (CPI) inflation as reported in line 64 of IMF (2000).

References

Baig, Taimur, and Ilan Goldfajn. 1998. Financial market contagion in the Asian crisis. IMF Working Paper no. WP/98/155. Washington, D.C.: International Monetary Fund.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny. 1998. A model of investor sentiment. *Journal of Financial Economics* 49:307–43.

Caramazza, Francesco, Luca Ricci, and Ranil Salgado. 2000. Trade and financial contagion in currency crises. IMF Working Paper no. WP/00/55. Washington, D.C.: International Monetary Fund.

Corsetti, Giancarlo, Paolo Pesenti, Nouriel Roubini, and Cédric Tille. 2000. Competitive devaluations: Toward a welfare-based approach. *Journal of International Economics* 51:217–41.

De Gregorio, José, and Rodrigo Valdés. 2001. Crisis transmission: Evidence from the debt, tequila, and Asian Flu crises." In *International financial contagion,* ed. Stijn Claessens and Kristin Forbes, 99–127. Boston, Mass.: Kluwer Academic.

Eichengreen, Barry, and Andrew K. Rose. 1999. Contagious currency crises: Channels of conveyance. In *Changes in exchange rates in rapidly developing countries: Theory, practice, and policy issues,* ed. Takatoshi Ito and Anne O. Krueger, 29–50. Chicago: University of Chicago Press.

Eichengreen, Barry, Andrew K. Rose, and Charles Wyplosz. 1996. Contagious cur-

rency crises. NBER Working Paper no. 5681. Cambridge, Mass.: National Bureau of Economic Research.
Forbes, Kristin. 2000. The Asian flu and Russian virus: Firm-level evidence on how crises are transmitted internationally. NBER Working Paper no. 7807. Cambridge, Mass.: National Bureau of Economic Research, July.
Gelos, Gaston, and Ratna Sahay. 2001. Financial market spillovers: How different are the transition economies? In *International financial contagion,* ed. Stijn Claessens and Kristin Forbes, 329–66. Boston, Mass.: Kluwer Academic.
Gerlach, Stefan, and Frank Smets. 1995. Contagious speculative attacks. *European Journal of Political Economy* 11:45–63.
Glick, Reuven, and Andrew K. Rose. 1999. Contagion and trade: Why are currency crises regional? *Journal of International Money and Finance* 18:603–17.
Goldstein, Morris, Graciela Kaminsky, and Carmen Reinhart. 2000. *Assessing financial vulnerability: An early warning system for emerging markets.* Washington, D.C.: Institute for International Economics.
Gupta, Poonam, Deepak Mishra, and Ratna Sahay. 2000. Output response during currency crises. International Monetary Fund. Mimeograph.
Harrigan, James. 2000. The impact of the Asia Crisis on U.S. industry: An almost-free lunch? *Federal Reserve Bank of New York Economic Policy Review* 6 (3): 71–79.
International Monetary Fund (IMF). 2000. International Financial Statistics [database on CD-ROM]. June.
International Trade Center, UN Statistics Division. 1999. Trade Analysis System for Personal Computers [database on CD-ROM].
Kaminsky, Graciela, and Carmen Reinhart. 2000. On crises, contagion, and confusion. *Journal of International Economics* 51:145–68.
Masson, Paul. 1998. Contagion: Monsoonal effects, spillovers, and jumps between multiple equilibria. IMF Working Paper no. WP/98/142. Washington, D.C.: International Monetary Fund.
Paasche, Bernhard. 2000. Credit constraints and international financial crises. Carnegie-Mellon University, Department of Economics. Mimeograph.
Pesenti, Paolo, and Cédric Tille. 2000. The economics of currency crises and contagion: An introduction. *Federal Reserve Bank of New York Economic Policy Review* 6 (3): 3–16.
Van Rijckeghem, Caroline, and Beatrice Weder. 2001. Sources of contagion: Is it finance or trade? *Journal of International Economics* 54 (2): 293–308.
Wincoop, Eric van, and Kei-Mu Yi. 2000. Asia Crisis post-mortem: Where did the money go and did the United States benefit? *Federal Reserve Bank of New York Economic Policy Review* 6 (3): 51–70.
World Bank. 2000. World development indicators [database on CD-ROM].

Comment Federico Sturzenegger

This paper combines a number of attractive features, each one of which is an important contribution in its own right. First, the paper constructs a new database that distinguishes different trade links among countries. This useful database is reproduced completely in the paper, making it

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available for everyone to use in future research. Second, the paper designs new tests with this database and, as a result, delivers some new findings. The results have relevant implications for policy design and crisis prevention.

Briefly, the main contribution of the paper is that it decomposes three types of mechanisms by which trade may determine the vulnerability of a country to crises in other countries: a *competitiveness effect,* which measures how a country may be affected as an exporter in a common third market; an *income effect,* which captures the way a crisis may affect the exports to the crisis country; and finally, a *cheap-import effect,* which works in the opposite direction, capturing the increased income as result of the country's ability to obtain imports at lower prices for the crisis country.

The results indicate that these channels are relevant for predicting the stock market performance response to a crisis. Furthermore, and perhaps most important from a policy perspective, it is shown that the propagation characteristics differ depending on the kind of crisis the ground-zero country experiences. For example, if the ground-zero country responds to the crisis by increasing interest rates rather than by depreciating the exchange rate, it is shown that the effects on other countries are not the same. This is obviously useful information for the design of policy prescriptions aimed at reducing the international spread of crises.

However, two questions come to mind when evaluating the empirical results. First, we need to ask to what extent these trade variables may be capturing something other than trade—perhaps, for example, the role of financial factors. This is the point made by Van Rijckeghem and Weder (1999), among others. My assessment of the debate is that to some extent this is probably so, but also that two factors tend to dilute the relevance of this criticism of the paper. First, even if we think of the trade variable as a composite of trade and finance effects, the links unveiled still provide information useful in assessing the vulnerability of other economies to a crisis. Second, and more important, the breaking up of the trade effects into the different channels, together with the fact that they work as expected, means that something beyond finance is going on here.

A more serious concern in the estimation refers to the way overlapping effects are taken into account. When the Tequila crisis hits Mexico, all countries in the region suffer. This, in turn, sets off a second round of income effects, and potentially competitiveness and cheap-import effects among the countries involved. However, the specification in equation (3) relates only to the ground-zero country and thus ignores these second-round effects. Consider, for example, a country like Peru. As a result of the Tequila crisis Peru was affected not only through its trade links with Mexico, but also through its trade links with Chile, Brazil, and other Latin American countries that were also affected by the Mexican crisis. All these other effects are left out of the estimation. In the end, this may imply that the co-

efficients may overestimate the impact of the ground-zero country while probably underestimating the overall trade effect.

One way to deal with this may be to define some very distinct and separate crises (my suggestions would be Tequila, Venezuela, Czech, Asia [beginning in Thailand], India, Russia, and Brazil) and let the whole effects play out. This could be done by introducing the relationship with all countries affected in the second round in equation (3), or by computing a matrix of relationships among countries and making these the independent variables in the estimation. In the current specification, a country may show a strong trade effect from its relation with the ground-zero country even when not trading with it, as a result of its trading with a third country that has a strong relation with both. In any case, these are interesting lines for future research.

This potential misspecification problem is further confirmed by looking at a particular country and checking how well the model predicts the impact of crises on the chosen measure, the stock market. Table 2C.1 computes the effect of each crisis on Argentina, thus expanding the examples presented in table 2.7. As can be seen, with the exception of the Brazilian crisis (which explains about 20 percent of the change in the stock market), all others appear to have had a very small impact. On the one hand, this can be considered supportive of the model. The crisis with Brazil was the only one affecting an important trade partner (the other important trade partners of Argentina are the European Union and the United States). On the other hand, the results cast some doubt on the specification of the model. As can

Table 2C.1 The Effects on Argentina

	Competitiveness Effect	Income Effect	Bargain Effect	Total Effect	Stock Market Change	Total Effect/Stock Market Change
Mexico	–0.09	–0.11	0.06	–0.14	–4.39	3.1
Ecuador (1)	–0.02	–0.06	0.05	–0.04	–2.24	1.6
Venezuela (1)	–0.04	–0.08	0.01	–0.11	4.78	wrong sign
Venezuela (2)	–0.08	–0.13	0.03	–0.18	2.21	wrong sign
Czech Republic	–0.03	0.00	0.01	–0.02	1.81	wrong sign
Thailand	–0.08	–0.05	0.02	–0.12	2.72	wrong sign
The Philippines	–0.02	–0.02	0.01	–0.03	1.07	wrong sign
Indonesia	–0.08	–0.08	0.02	–0.14	–2.12	6.6
Korea	–0.12	–0.07	0.11	–0.09	3.76	wrong sign
India	–0.14	–0.07	0.03	–0.18	–2.89	6.2
Russia	–0.34	–0.16	0.06	–0.44	–6.73	6.6
Venezuela (3)	–0.09	–0.11	0.01	–0.19	5.05	wrong sign
Slovak Republic	–0.01	0.00	0.01	–0.01	–6.41	0.1
Ecuador (2)	–0.02	–0.03	0.02	–0.03	0.57	wrong sign
Brazil	–0.40	–2.62	1.52	–1.50	–6.99	21.5

Note: All numbers are percentages.

be seen from the table, the Venezuelan crisis of 1998 is estimated to have had a larger impact on Argentina than did the Tequila crisis—such was not the case, however. In fact, the Tequila crisis had such a large effect on Argentina that it even triggered a crisis there by March 1995. Furthermore, many crises that did not affect Argentina (Thailand, the Philippines, etc.) are predicted by the model to have had an effect. Two interpretations in line with the discussion above can thus explain why the table gives an interpretation of the links that does not match our prior beliefs. The first is that, except for some very obvious cases, trade effects are certainly overshadowed by financial effects (and even in the geographically proximate cases, the trade effect may be picking up some financial link effects). The second is that the cross-effects are not properly taken into account, so that the model has difficulties distinguishing between crises with stronger regional effects and those that do not.

Another concern that can be raised is the use of stock market data, rather than a contagion or crisis dummy, as dependent variable. The latter has been the standard practice in the literature (see, e.g., Eichengreen, Rose, and Wyplosz 1996; Glick and Rose 1999; and Edwards, chap. 1 in this volume). Yet the choice of the stock market data has also received support in the literature. Kaminsky, Lizondo, and Reinhardt (1998) identify sharp declines in equity markets as being among the best indicators of forthcoming currency crises. Work at investment banks, such as Ades, Masih, and Tenengauzer (1998), also uses the stock market (together with other variables) as a predictor of financial crises in emerging markets.

The use of the stock market data has the appeal of capturing the whole market-value effect of the propagation (and its predicted future effect), but has the disadvantage that it is likely to mix real, financial, and contagion effects. Stocks measure the present discounted value of future dividends, and thus can change through changes in the numerator (dividends) or the denominator (discount factor). The changes in the numerator are the direct links one would like to associate with trade. However, the price of stocks may be affected by changes in the discount factor, which I like to associate with pure contagion or with a financial channel. In this regard, the use of this dependent variable is particularly susceptible to mixing financial and trade effects.

The paper fits in a tradition of papers that try to unveil the propagation mechanisms of crises among countries. It probably will not settle the debate as to whether the effects are financial or trade related. It is likely that the debate will never be settled, in fact, because it is not one or the other but both, which surely play an important role. Furthermore, if trade effects are important, shouldn't one expect an effect on country risk and financing costs?

In spite of leaving this issue unsettled, the paper makes an important contribution: By unveiling the different channels by which trade works and by making the point that the way the crisis is handled has implications for how

it propagates, it gives us a better understanding of crises than the one we had before reading the paper.

References

Ades, Alberto, Rumi Masih, and Daniel Tenengauzer. 1998. GS watch: A new framework for predicting financial crises in emerging markets. Goldman Sachs, Economic Research. Unpublished paper.

Eichengreen, Barry, Andrew Rose, and Charles Wyplosz. 1996. Contagious currency crises. NBER Working Paper no. 5681. Cambridge, Mass.: National Bureau of Economic Research.

Glick, Reuven, and Andrew Rose. 1999. Contagion and trade: Why are currency crises regional? *Journal of International Money and Finance* 18:603–17.

Kaminsky, Graciela, Saul Lizondo, and Carmen Reinhardt. 1998. Leading indicators of currency crises. *IMF Staff Papers* 45 (March): 1–48.

Van Rijckeghem, Caroline, and Beatrice Weder. 1999. Sources of contagion: Finance or trade? IMF Working Paper no. WP/99/146. Washington, D.C.: International Monetary Fund.

Discussion Summary

Anne O. Krueger commented that the paper controlled only for whether there was a change of real exchange rate, but that it did not take into account the magnitude of the change. She suggested that the author include the real exchange rate changes weighted by shares of bilateral trade as a control variable. Krueger cited her study on the impact of real exchange rate change on India's trade, in which she found a large effect of real exchange rate.

Amartya Lahiri commended the paper for isolating each margin on which that trade can affect the international transmission of crises. He also said, however, that the overall effects of trade on crisis transmission seemed to be quite small. Moreover, since the sample contained a group of heterogeneous countries, the assumption that the trade effects are the same across countries is not likely to hold.

Linda S. Goldberg made two remarks. First, regarding the paper's conclusion that trade matters more than macrovariables, she posed the question whether trade per se matters or is just a conduit for real effects of exchange rate changes. Second, she remarked on the related literature. She found the equation used in the paper for computing the competitive effect reminiscent of the exchange rate pass-through literature and she suggested the author to relate the two. She also noted the literature on the link among exchange rates, investment, and stock prices. The paper's discussion on industry structure and the pricing for different countries and industries fits well into that literature.

Eduardo Borensztein wondered whether the aggregate stock market index

really measured countries' vulnerability to crises. He said that in some countries the stock market is not comprehensive and is dominated by a few companies that are unrelated to international trade. Borensztein also commented on the definition of crises, and he suggested using three standard deviations as the cutoff level between tranquil and crisis periods. Recognizing that some countries have experienced increases in exchange rate volatility over time, he said that one could take a rolling sample in those cases.

Roberto Rigobon commented that the prediction exercise of the paper is performed within the sample, and that it should be performed out of sample.

Giancarlo Corsetti commended the paper for putting together a trade data set that is finally close to our theories.

Shang-Jin Wei commented that trade effects might not be stable across different crisis periods because the magnitudes of the crises were very different, and that this might have contributed to the seemingly abnormal results of the paper. Wei suggested solving this problem through redefining trade effect variables by including the actual decline in the crisis countries' income levels. Second, Wei noted that the paper focused on the direct trade effects in the international transmission of crises and said that there can be subsequent rounds of indirect trade effects. For example, Korea suffered directly from the Thai devaluation as well as from the Indonesian devaluation resulting from the Thai crisis. He said that one way to capture these indirect effects is to use a longer window of stock returns.

Nouriel Roubini suggested that the paper should control for channels of financial contagion for the following two reasons. First, controlling for such channels could shed some light on the source of contagion (i.e., whether it is trade or common creditors in financial markets). Second, the paper used stock market returns to measure a country's vulnerability to crises, but reasons other than trade could potentially explain the findings of the paper. For example, if there is a crisis in a country, it usually crashes its stock market and leads to contagion through financial channels. That is, crises could be transmitted from one financial market to another through financial channels as opposed to trade channels. Therefore, one has to control for the financial contagion when studying trade effects in transmitting crises in order not to overstate the results.

On using stock market returns to measure countries' vulnerability to crises, *Kristin J. Forbes* replied that the paper uses this measure to capture how the country as a whole is affected by crises. Stock market returns capture not only the immediate impacts, but also the expected longer-term impacts, and therefore are a preferred measure. Some of the trade effects, such as the competitiveness effect, will take a long time to work their way into other variables. Other advantages of using stock market returns are that they are widely available for a range of countries, and they are high frequency, especially important when crises occur one after the other. Stock

return data are among the few variables that are available at a sufficiently high frequency to isolate the impacts of different crises that are bunched together in time.

On the definition of crises (exchange-market pressure index), Forbes said that the paper used a high cutoff level—five standard deviations—because of the higher volatility in the weekly data (versus monthly or quarterly data used elsewhere). She promised to redefine the crisis index with a lower cutoff level, which may imply a larger sample.

Finally, on the importance of trade effects, Forbes agreed with others that trade is important, but maintained that it is not the whole story: It explains only a quarter of the variation in stock market returns. She also emphasized, however, that the overall trade effects should be multiplied by the number of weeks that a crisis lasts.

II

International Financial Players and Contagion